DOCUMENT RESUME

ED 355 016 PS 021 187

AUTHOR	Richter, Ricka
TITLE	A Critical Evaluation of Cognitive Style Assessment.
INSTITUTION	Human Sciences Research Council, Pretoria (South Africa).
REPORT NO	ISBN-0-7969-1208-4; PERS-453
PUB DATE	92
NOTE	134p.
PUB TYPE	Reports - Evaluative/Feasibility (142)
EDRS PRICE	MF01/PC06 Plus Postage.
DESCRIPTORS	*Cognitive Style; *Cognitive Tests; Educational Psychology; Epistemology; Foreign Countries; Job Training; *Learning Theories; Personality Assessment; Systems Approach
IDENTIFIERS	*Jung (Carl G); Myers Briggs Type Indicator; *South Africa

ABSTRACT

This document reviews theories of cognitive style and methods of cognitive style assessment as they relate to the context of South Africa, where sociopolitical changes call for reassessment of theoretical assumptions in education and training. The report consists of six chapters. After a brief introductory chapter, the second chapter gives an overview of theories of intelligence and cognitive functioning. The use of problem-solving tasks as instruments for cognitive style assessment is presented. The third chapter contains a discussion of the current status of cognitive style theory and research. Topics discussed include a critique of the reliance on lab and paper-and-pencil tests as assessments of cognition; and a discussion of the practical implications for choosing training methods. A discussion of the relations between theories of learning style and education, which focuses on the cognitive styles of teachers, is contained in chapter 4. The fifth chapter describes the Jungian theory of personality as a systematic theory of cognitive styles, and the Myers-Briggs Type Indicator as a cognitive style and learning style measure. The final chapter outlines suggestions for future research and development of an instrument to measure cognitive and learning styles. (Contains 165 references.) (ME)

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A CRITICAL EVALUATION OF COGNITIVE STYLE ASSESSMENT

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A CRITICAL EVALUATION OF COGNITIVE STYLE ASSESSMENT

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HUMAN DEVELOPMENT
GROUP: HUMAN RESOURCES

A Critical Evaluation of Cognitive Style Assessment

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ISBN 0 7969 1208 4

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Printed by HSRC Publishers
134 Pretorius Street, Pretoria

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EKSERP

Die eise wat opvoedkundige instansies en die nywerheid in Suid-Afrika aan kognitiewe evalueringsmetodes stel het onlangs dramatiese veranderinge ondergaan. Konvensionele toetse en tradisionele keuringsmetodes is ontoereikend vir gebruik as keurings- en opleidingsmiddele, veral wanneer die veranderende aard van die Suid-Afrikaanse politieke, ekonomiese en sosiale situasie oorweeg word. Alhoewel 'n verskuiwing in fokus in kognitiewe sielkunde vanaf die psigometriese benadering tot die inligtingsverwerkingsbenadering plaasgevind het en die evaluering van kognitiewe style eerder as vermoëns voorgestaan word, toon 'n oorsig van die toetse wat tans gebruik word vir die evaluering van individuele verskille in die gebruik van kognitiewe prosesse wat inherent is aan kognitiewe style, die ontoereikendheid daarvan. In hierdie verslag word 'n ander perspektief, die sisteembenadering, ondersoek as grondslag vir die evaluering van kognitiewe style. Kognitiewe style omvat meer as net kognitiewe veranderlikes en sluit ook in persoonlikheids-, interpersoonlike, sosiale en kulturele veranderlikes. Sekere teoretiese modelle word bespreek vir gebruik as teoretiese agtergrond tot die ontwikkeling van nuwe instrumente om kognitiewe style te evalueer en te dien as opleidingsmiddele, wat in staat is om individuele verskille op 'n prosesvlak te evalueer. Die ontwerp van 'n nuwe instrument, gebaseer op die teorie van Jung en die inligtingsverwerkingsparadigma, word voorgestel, wat essensieel is vir die ontwikkeling van die potensiaal van individue, aangesien die mense wat die Suid-Afrikaanse bevolking verteenwoordig 'n belangrike hulpbron daarstel wat tot dusver grootliks verwaarloos is. Dit is 'n uiters belangrike onderneming indien ons van plan is om regstellende aksie deur te voer sonder om die kwaliteit van die produkte waarvan ons nywerheid afhanklik is vir oorlewing, te benadeel.

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ABSTRACT

The demands placed on cognitive assessment methods by educational institutions and industry in South Africa have recently undergone major changes. Conventional tests and traditional selection methods are inadequate for use as selection and training devices, especially when the changing nature of the South African political, economic and social situation is considered. Although there has been a shift in focus in cognitive psychology from the psychometric approach to the information processing approach and the assessment of cognitive styles rather than abilities, a review of the tests currently in use lead us to question the relevancy of the so-called cognitive style assessment devices to the evaluation of individual differences in the use of cognitive processes inherent in cognitive styles. In this report a different perspective, the systems approach, is explored as basis for the assessment of cognitive styles, which are seen as comprising more than just cognitive variables, but also include personality, interpersonal, social and cultural variables. Certain theoretical models are discussed for use as theoretical background to the development of new cognitive style assessment and training devices, capable of evaluating individual differences on a process level. The design of a new instrument, based on Jungian theory and the information processing paradigm, is proposed, which is vital for the development of the potential of individuals, since the individuals comprising the South African population represent a major resource which has so far largely been neglected. This is a crucial endeavour if we intend to institute affirmative action without damaging the quality of the products on which our industry depends for survival.

1.0 INTRODUCTION

During the early twentieth century, scientific enquiry in psychology was influenced by three major paradigms of thought, namely structuralism, behaviourism, and the psychoanalytic viewpoint. These paradigms espoused the Cartesian-Newtonian dichotomy, a mechanistic world view which conceives of all entities as knowable. Human beings are seen as analogous to a machine. Regardless of whether the scientific investigation involved human beings and their behaviour, or inanimate natural objects, the laws of nature were equally applied to both, thereby reducing both behaviour and matter to simple units, with the prime objective precise measurement. The pervading influence of this perspective has resulted in us seeing things as opposites and/or separates, making it difficult to see things in relation to one another.

During the last few decades a different world perspective has developed, the systems approach. According to this perspective the world is conceived of as an inseparable dynamic whole, consisting of parts which are interdependent and in continuous interaction. Studying individuals from a systemic perspective requires us to change our conceptualization of humans and the world, and ultimately reality, so that individuals, aspects of their behaviour, and the context in which both appear are seen as an integrated whole.

This report, which focuses on cognition and more specifically, cognitive styles, is an attempt to provide an integrated view of the individual by considering all the correlates involved in establishing cognitive styles, such as learning and personality factors. Cognitive functioning and individual differences are discussed by taking into account cognitive, learning and personality factors as these influence problem solving in educational and organizational settings. In so doing we follow a holistic approach, which considers the individual as an integrated whole by including the context of his/her functioning, rather than an atomistic approach.

In cognitive theorizing and research, as in most other psychological disciplines, the major goal has been and mostly still is, the discovery of exact rules by which behaviour can be explained. However, according to the systems perspective it is incorrect to assume that there is only one correct explanation for a certain phenomenon, a viewpoint which is the antithesis of the mechanistic perspective, which advocates that only one solution or explanation for any phenomenon exists (Mitroff, 1982). Since no single theory in the field of cognitive psychology has managed to offer a comprehensive and precise explanation about the nature of cognition and cognitive styles in human functioning, this report draws on the work of many cognitive and personality theorists who made unique contributions to this field. In order to remain true to the systemic approach and because no single theory is completely comprehensive, valid and reliable, this report uses the various theories in a complementary fashion, extracting from each that which is beneficial for our purpose.

The reader should note that this report is not simply an overview or a summary of theoretical information and empirical data, which can be obtained from the reading of selected texts and which will make this report superfluous; rather, we are interested in presenting an integrated view of cognitive styles, as well as considering the implications of the theoretical and empirical data for the well-being and development of human beings. South Africa is in a unique position, in that people from many cultures find themselves interacting in a variety of situations, whether these be in an educational setting (which we will see more of in the future as we move further away from the apartheid regime) or in an organizational setting. People from different cultures are competing for positions in educational settings, such as universities, and positions in organizational settings. This has important implications for research. It becomes imperative to ask appropriate questions, such as how the position of those individuals who find themselves not only competing for various positions, but who are also disadvantaged because of many contributing factors, one of which is the current educational system, can be bettered. Thus, the aim is not so much the search for "epistemic truth", but rather to find ways in which the data can be used for the development and advancement of individuals.

Since we are interested in the advantages of the different theories of cognition, we offer an overview of theories of intelligence and cognitive functioning in Chapter 2. A short review of individual difference psychology is presented, and it will be shown how this theory fits in with cognitive style conceptualizations. The use of problem solving tasks as instruments for the assessment of cognitive styles is also presented, including the role of metacognitive processes as it pertains to problem solving.

Cognitive style assessment has been executed predominantly with the use of laboratory and paper-and-pencil tests, which have many methodological problems, and to a great extent cognitive style theorizing has built on the results obtained from the use of such tests. This will be demonstrated in Chapter 3. This chapter also examines the most researched and therefore the most popular cognitive style dimensions and measurement instruments and evaluates these in terms of the requirements for the theoretical operationalization and empirical validation of cognitive styles. The practical implications of research will be considered, including the value of the different training methods adopted to teach individuals to use different types of cognitive styles. In the last part of this chapter more comprehensive cognitive style theories, as well as the use of self-report instruments to assess thinking styles, will be discussed.

In Chapter 4 theories of learning styles and the implications and value thereof for education and training are discussed. We will look at the cognitive styles of teachers and instructors, and focus on the influence these individuals have on their students.

The fifth chapter focuses on the Jungian theory of personality as a systemic theory of cognitive styles, and the Myers-Briggs Type Indicator as a cognitive style and learning style measure.

Chapter 6 outlines some suggestions for future research and developments for education, selection procedures, training, and has specific implications for the development of an instrument to measure cognitive and learning styles in order to train individuals to be better and more effective problem solvers. Research of this nature will not only facilitate our knowledge and understanding of the individual and his/her functioning, but will also enable us to make more effective use of our human resources through the use of better assessment and training instruments.

2.0 COGNITIVE ASSESSMENT: AN OVERVIEW

This chapter is an overview of the evolution of the different theories of intelligence and cognitive functioning, especially as these concern the development of cognitive assessment instruments. In the field of cognitive theorizing and measurement two major paradigms exist, the psychometric approach and the information processing approach, each displaying unique characteristics. In spite of the formulation of progressively complex theories, no single theory enjoys total acceptance. Sternberg (1981) formulated a model for the conceptualization of theories of intelligence, which clarifies the importance of the different theories for the development of trends in cognitive style theorizing and assessment, and which has been chosen as framework for this presentation.

According to Sternberg's proposed model, theories of intelligence follow a relatively certain course of evolutionary growth, within the context of the prevailing world view, which consists of three successive stages. Each stage represents successive degrees of complexity regarding theorizing; therefore, the development of cognitive assessment instruments also fits into these stages, depending on the rationale used for such developments.

Stage I is distinguished by the existence of one or more theories which are polarized in terms of a monism-pluralism continuum. On the one end of the continuum there is a monistic theory which advocates one source or process underlying intelligence, while on the other end there is a pluralistic theory which argues that there are multiple independent sources or processes underlying intelligence. Conflict between these competing views is resolved by an evolutionary developmental change whereby the two merge in Stage II, emerge again and once again compete with one another.

What is important in Stage II is not the number of sources or processes postulated to underlie cognitive functioning but rather the organization of these. On the one end of the continuum theories postulating a hierarchic system are found, while on the other end theories postulating multiple sources or processes which overlap in units (non-hierarchy) and are interdependent are found. Stage III of the model is entered when these two opposite views again merge into one integrated theory incorporating all the previous views. The notion of hierarchy is combined with the notion of non-hierarchy. The resolution of tension in this way, however, gives rise to another kind of tension, i.e. a realization that all the questions have still not been answered, or have not been satisfactorily answered, and an awareness that there is nowhere qualitatively new to go with the chosen approach. This brings about three options, namely stagnation, the development of a new sub-approach, that is, the investigation of the original problems from a new point of view, or the reconceptualization of the problem in terms of a new world view, which will return theorizing to Stage I of the model.

Using the above model as a frame of reference, the various theories, in terms of the time perspective on which they are dependent, will now be discussed.

2.1 THE MECHANISTIC APPROACH TO COGNITIVE ASSESSMENT

The measurement of intelligence started out in the nineteenth century, at a time when the mechanistic or classical world view (also called the Cartesian-Newtonian world view) was adopted by scientists and philosophers. This resulted in the psychometric approach to the measurement of intelligence, which is based on the concepts advanced by the "hard sciences" such as physics, and which fits well into the mechanistic world perspective according to which individuals and machines are viewed as functionally equivalent. Therefore, the psychometric approach has enjoyed much support, especially during the first half of this century.

In terms of this world perspective, the world and everything in it, was conceived of as knowable entities which could be reduced to simple parts and measured precisely. This assumption was based on the premise that since everything exists in a certain amount and is quantifiable, one can objectively measure, understand, predict and eventually control phenomena (in this case intelligence or cognition, although the same applies to tangible phenomena as well). By focusing on different parts of the individual as separate elements, it was believed that the individual would be fully understood, and through understanding behaviour would become predictable and be amenable to change. One of the major goals of the psychometric approach has, therefore, been the search for better instruments to assess human abilities in order to predict future performance (Elkind, 1981).

One of the features of the psychometric approach as manifested in the above theories is that it regards linear cause-and-effect relationships as determinants of behaviour, i.e. how much of an ability an individual possesses and to what degree of efficacy he or she employs it determines how intelligent that person is. Thus intelligence is conceived of as consisting of a set of underlying abilities, or a type of mental power (Vernon, 1984). Individual differences in test scores represent differences in underlying abilities. A very definite linear cause-and-effect relationship is implicit, in which everything operates according to definite rules, so that less of an ability will result in a lower test score, while more of the same ability will result in a higher test score, without considering other factors in determining an individual's ability on a certain factor. To identify the factors underlying individual differences factor analysis is used (these are called correlational based theories [Sternberg, 1981]) and each of the identified factors is regarded as a separate ability. These theories represent Stage I theories, a category into which both Spearman's and Guilford's theories fit, with Spearman's two-factor theory of intelligence an example of a monistic theory, and Guilford's three-dimensional model comprising as many as 120 factors, differing in terms of their operations, content, and products, an illustration of a pluralistic theory.

An example of a Stage II non-hierarchic theory is Thurstone's multifactorial model of intelligence which developed partly as a reaction against the mechanistic stimulus-response theories. According to this theory mental life is viewed as action in the process of being formulated while cognition is viewed as residing within the individual, as opposed to simple responses to external stimuli. Burt's theory (see Sternberg, 1981) and Royce's theory (to be discussed in section 3.5) of personality and intelligence are examples of hierarchical theories.

As far as Stage III is concerned, Sternberg views only one correlationally-based theory as relevant, namely Guttman's radex theory (see Sternberg, 1981).

These theories (especially Stage I theories), whereby mental life is equated to mechanistic constructs, focused on structure and represent a static view of humans and cognition. Much criticism has been launched against this view of intelligence, to the point that it is viewed as totally outdated since it provides a static picture of the individual's mental capacity without any reference to the developmental process or remediation of weaknesses (Vernon, 1984).

Other problems experienced from the use of conventional testing methods include the following:

(a) difficulties to differentiate between alternative factorial theories and to determine which factorial theory is the "right" one through the use of factorial methods of analysis;
(b) the almost exclusive reliance on factorial methods of individual differences for the identification of constructs which represent intelligence, accompanied by the

assumption that structure can only be a part of intelligence if it represents individual differences in task execution; and

(c) the failure of factorial methods to identify the processes necessary for task execution (Sternberg, 1983).

Despite severe criticism the fact remains that cognitive assessment through the use of tests measuring cognitive abilities is still used extensively to make decisions concerning individuals' lives - whether the goal is placement in school courses, counselling for career planning and admittance to university courses, or job selection. There are instances where the futures of individuals are drastically influenced by decisions made on the basis of the results of these tests. Nevertheless, no matter how convincing the evidence against the use of conventional tests, to say that the psychometric approach is obsolete, would be premature. Conventional tests still have their place in assessment and it is unlikely and undesirable that they should be completely discarded. Many of these tests have been shown to have high validity and reliability and provide consistent measures of intelligence. However, in this report we are not so much concerned with the merits or shortcomings of conventional tests but rather with the effects of the use of these type of tests as instruments when conducting research into cognitive styles. For example, as will be demonstrated in the discussion on cognitive styles (see section 3.1), many instruments professed to be tapping style differences are actually nothing more than ability measures, which renders the conclusions drawn from such research studies suspect. It is here, where one would expect instruments developed solely for the assessment of processes, that we find the unfortunate marriage of process theorizing to structural or ability measurement techniques.

2.2 THE SYSTEMIC WORLD VIEW AND COGNITION

In recent years another influential approach to the conceptualization of intelligence has been the information processing approach (experimentally-based theories). This approach fits in with the systemic world perspective and arose in protest against the psychometric approach. The information processing approach attempts to clarify the process as well as the structure of intelligence. Information processing theories are a manifestation of a shift in world view from a linear to a systemic approach. Whereas the psychometric approach sees intelligence as static (or stable), that is, at a certain stage in an individuals' life he/she reaches a peak or maximum point in intellectual development so that test scores reflect an ability asymptote, the 'information processing approach is more dynamic in that an individual is seen as having the capacity to change and grow intellectually. In contrast to the psychometric approach which attempted to understand intellectual abilities in terms of patterns of individual differences in intelligence test scores, the information processing approach focuses on underlying cognitive processes which facilitate intelligent task execution.

Using Sternberg's model as framework for the understanding of the evolutionary development of information processing theories, it can be seen that Stage I theories include the theories of Gestalt psychology (monistic) and stimulus-response psychology (pluralistic). These theories have merged into Stage II theories, namely the hierarchical, executive-based theories (information processing theories with a characteristic distinction between metacognitive and cognitive processes) and non-hierarchical theories (which do not distinguish between metacognitive or executive and cognitive or non-executive processes). According to Sternberg (1981) current experimental theorizing is on the verge of entering Stage III. We are especially interested in those theories which are hierarchical and executive-based, because of the importance of metacognitive processes in the determination of cognitive styles.

The problem with experimentally-based theories is that individual differences are not taken into account (Taylor, 1987) but rather focus on general laws which are seen as equally applicable to all individuals.

The information processing perspective attempts to understand intelligence in terms of the underlying processes which combine differentially to represent intelligent task execution. Although the primary focus is on process identification, the information processing perspective also attempts to identify the speed and problems with which these processes are executed, the combination of these processes into strategies for task execution, the cognitive representations working on the underlying processes and strategies and the allocation of attention and other processing resources regarding many aspects of a given task. Thus, instead of only focusing on the structural aspects of intelligence as is done in the case of the psychometric theories, the focus is both on structure and process.

Hunt (1983) points out that explanations offered by information processing theories are often based on the principles of computer processing and he stresses, as cognitive aspects of importance to the information processing approach, the importance of internal representation of the external world, strategies for task execution and elementary mental operations. Thus, while the psychometric approach attributes individual differences to a set of underlying abilities, the information processing approach regards individual differences as the result of the abovementioned cognitive functions, i.e. process differences. Again, we see the dynamic and holistic nature of systems thought, i.e. systemic thought is process thought (versus thinking in pure structure terms).

Information processing theories can also be placed on a continuum, with those that see intelligence in terms of simple perceptual-motor information processing on the one end and those that see intelligence in terms of complex language comprehension and problem solving on the other end. Sternberg (1983) places his componential theory at the complex end of the continuum and sees it as a synthesis of the psychometric and information processing approach, conceptualizing intelligence in terms of abilities, structures and processes (for a complete discussion and critique of this theory see Sternberg, 1983, 1984).

Since a cognitive style orientation is concerned with process differences in thinking rather than quantitative or qualitative differences in intellectual abilities, the developments in this field of enquiry are especially important. Unfortunately, research into the development of process-oriented instruments for assessment of cognitive styles are virtually nonexistent. This could be part of the reason why researchers so readily revert to the use of psychometric instruments for the assessment of cognitive styles.

Metacognition or the use of metaprocesses is an important factor in the assessment of process differences, especially when assessing cognitive styles. According to Taylor (1987) a metaprocess can be defined as an executive or control activity necessary for successful task execution or solution.

The five classes of metacognitive processes important for problem solving identified by Taylor (1987) are:

1. *Planning*, which involves the steps necessary to be used to execute the task;
2. *Monitoring*, referring to the effectiveness of the steps;
3. *Testing*, that is testing of one's strategy as the need arises;
4. *Revising* of strategies as the need arises;
5. *Evaluating* of strategies for effectiveness.

Sternberg (1984), in his triarchic theory of intelligence, identifies seven metacomponents necessary for the execution of tasks:

1. identification of the nature of the problem;
2. selection of a set of lower-order components for the execution of a task;
3. selection of one or more mental representations for information;
4. selection of a strategy for use of lower-order components;
5. decision regarding how attentional resources should be allocated;
6. monitoring of task execution;
7. orientation towards external feedback.

It is important that the metacognitive processes necessary for the successful execution of problem solving tasks be stated explicitly when evaluating cognitive styles, since these can reveal individual differences and unique patterns used in problem solving.

2.3 THE STUDY OF INDIVIDUAL DIFFERENCES

There is a trend in cognitive psychology, in accordance with the tenets of systemic thinking, to move away from the exclusive study of structures and underlying mechanisms of intelligence to an ecological perspective, the reason being the need to understand and predict the behaviour of individuals in real life contexts as well as the acknowledgement that a wide range of individual differences exist in thinking. Ecological valid studies take social and cultural contexts into account, and thus, produce performance data and reveal habits and strategies (Cohen, 1983), which improves the understanding of the individual case. Furthermore, understanding the individual's thinking processes has diagnostic value in that training programmes can be designed to assist individuals with learning and problem solving (Taylor, 1987; Thier, 1989; Vernon, 1984). Also of importance is the understanding of the causal mechanisms involved in creating these differences. It is to an individual's advantage to understand his own and others' thinking styles and to learn to use different strategies for solving different types of problems.

As mentioned previously, experimentally-based studies do not take heed of individual differences, a serious shortcoming. Taylor (1987) maintains that the instruments created by individual difference psychologists do not pay enough attention to the precise content and the processes required for task execution. What becomes an important goal is the discovery of general laws of behaviour, as well as the relevance of these laws to the individual. The difficulty, facing psychologists in the study of individual differences, is the integration of the two approaches (Kolb, 1984; Taylor, 1987). As far as research in cognition is concerned, much has been done to determine which cognitive operations are involved in problem solving but what is now necessary is to determine how these cognitive operations or processes are used in a unique manner by the individual to assimilate and process information in order to solve problems, i.e. the study of cognitive styles.

2.3.1 Typologies and Styles of Individual Differences

Cohen (1983) proposes that simply recording different patterns of an individual's behaviour is not of any value; instead he regards the *classification of individuals into types* in order to determine which of and how the individual's characteristics influence his unique pattern of cognitive abilities and performance on cognitive tasks, as more important. The purpose of such a typology would be to relate individual characteristics to cognitive abilities. When focusing on performance focusing merely on how much of an ability a person possesses does not answer adequately how that person solved the problem. Therefore, it has become imperative to consider the variety of problem solving strategies or cognitive styles which characterize performance. These strategies or styles are personalized to a high degree. Such a typology represents prototypical examples of behaviour with individuals differing along a continuum in any one of two directions away from the central point. Using a typology for classification or categorization is necessary to organize our theorizing and to be able to generalize and predict behaviour.

The notion of a typology is not new. Human individuality has been recognized for many centuries, and philosophers have attempted to understand how individuals differ during the classical age, an example being the theorizing of the gnostic philosophers who thought of individuals varying along three dimensions, namely the pneumatici (a thinking orientation), the psychici (a feeling orientation) and the hylici (a sensation orientation). Schiller, in the eighteenth century, divided individuals according to realists and idealists, naive and sentimental types; Nietzche, in the following century, proposed his own typology, the Appolonian-Dionysian typology (see Jung, 1971, for a complete discussion on early type theorizing). Jung (1971) using the works of these philosophers and his own observations, created his own typology which is applicable to understanding both the individual personality and thinking as an integrated process (see Chapter 5). Theorists like Jung were interested in the variety of strategies people use in their approach to the environment and problem solving and theories such as these illustrate the link between personality and thinking or problem solving style.

The use of typologies to structure perceptions of individuals has advantages as well as disadvantages. Characteristics may be attributed to an individual because of the category characteristics, without these necessarily fitting the individual. Stereotyping which is categorization by means of a typology should be avoided and is a criticism which is frequently levelled against typologies. Individual uniqueness and complexity are in danger of becoming trivialized and it may detract from focusing on details and nuances of specific behaviour, especially when we are interested in finding a good fit for our typologies (Kolb, 1984; Mischel, 1979). A framework - in this case a typology - is needed for the understanding and prediction of behaviour, and the design of measurement instruments for the assessment of patterns of cognitive functioning or styles, without losing sight of the variability within types. Typologies are, in this sense, important since they help the observer to control his thoughts and not to be overwhelmed by too much information. The observer should, however, keep in mind the constraints of such a typology and the variability within types so that biased observations can be avoided. Types should be viewed as a guideline and it should not be expected that "pure" types will be found, a phenomenon which is very rare.

Kolb (1984) proposes a contextualist view for the study of human individuality, instead of the mechanistic view which have fallen prey to the abovementioned shortcomings, whereby types are thought of as universal and the ultimate truth. By following a contextualist view, types are conceptualized as "stable states" rather than "fixed traits", originating from "consistent patterns of transactions between the individual and his or her environment" (Kolb, 1984, p. 63). Mechanistic thinking focuses on structure, and therefore types are seen as fixed with growth and change impossible, whereas contextualist thinking focuses on the interrelatedness of the individual and the circumstance, and therefore growth, change and development are both possible and desirable. This represents a much more optimistic view of man. By following a contextualist view, the study of individual differences becomes process-oriented.

2.4 THE USE OF PROBLEM SOLVING IN THE STUDY OF COGNITIVE STYLES

It is argued that many of the tests used to study style dimensions actually measure abilities (see section 3.2). Therefore, the use of problem solving tasks to study stylistic differences is recommended. A problem solving approach enables the researcher to study the metacognitive control processes being used which is important for purposes of diagnosis and remediation (Taylor, 1987). Apart from this, it is possible to evaluate the individual differences with respect to strategic preferences which characterize the problem solver and which are not due to the characteristics of the problem, as these remain constant for all subjects. It is also important that the problem solving tasks presented be meaningful.

The term problem solving style is sometimes used as synonymous with cognitive or thinking style, but in this report this term will not be used in this context as it can refer to tasks other than purely cognitive in nature and is regarded as much broader than the term cognitive style. The term problem solving in this report will refer to a specific task or series of steps necessary to solve a problem.

From the literature (Goldner, 1957; Heppner & Krauskopf, 1987; Taylor, 1987) the following definition of problem solving, as it relates to style research, is formulated: Problem solving involves:

(1) a goal-directed sequence of cognitive operations (or goal-directed thinking) involving multiple steps to solve a problem,
(2) which has a well defined starting point and goal point and
(3) involves a clear set of rules which defines the problem space (that is, the problem has a well defined problem space);
(4) with the individual being able to understand the nature of the problem because of prior learning or acquired knowledge but being faced with an obstacle to a solution;
(5) without the availability of a clear set of steps necessary to do the task;
(6) but for which a solution is possible.

This process is not regarded as linear stage-sequential but rather as complex, dynamic and highly interactive. The above definition provides a description of problems but all problems do not necessarily have these characteristics. From the above description it can also be seen that problem solving is viewed as a circular process, eg. from selection of a problem, the consideration of alternative solutions, the evaluation of consequences of the solutions, the execution of a solution, the choosing of a model or goal, comparison thereof with reality, the identification of further problems, and back again to selection of a problem.

Generally problem solving activities involve the following: encoding, goal setting, development of plans and problem solving actions. Another important activity is evaluation of the solution (Anderson, 1983 in Heppner & Krauskopf, 1987). Many of these activities encompass metacognitive processes.

Encoding, for example, involves gathering of information in order to arrive at a complete picture or representation of the problem and to accurately evaluate the meaning of the problem, i.e. construction of a "problem space" (Cohen, 1983; Heppner & Krauskopf, 1987). When encoding is not successful it can be due to inadequate gathering of information, misunderstanding or an inaccurate evaluation of information gathered, or even an inaccurate evaluation on the part of the individual regarding his own ability to solve the problem.

Goal setting involves organizing problem solving behaviour. Successful goal setting is dependent on accurate encoding of the problem and the setting of specific goals which serves to organize the problem-solving process purposefully. When goal setting is not successful it may be due to one or more of several reasons such as inadequate encoding of the problem, a failure to set goals and organize the problem, confused problem-solving activities, etcetera, depending on the type of problem facing the individual.

Development of plans or selection of operations and ***"pattern matching"*** involve the retrievement of information from the knowledge base and the application of this knowledge to the development of plans to solve a problem (Anderson, 1983 in Heppner & Krauskopf, 1987). According to Heppner and Krauskopf (1987), successful development of plans involves successful encoding and goal setting, sufficient search of the knowledge base to develop plans, a consideration of all the possible solutions, a consideration of the steps necessary to arrive at these solutions, an analysis and comparison of the various alternatives and effective decision making regarding these alternatives or solutions. When development of plans is unsuccessful it usually involves a failure to pose solutions, a failure to consider steps necessary to reach a solution, a failure to compare and evaluate solutions, ineffective decision making, inappropriate plans, and/or a failure at one of the two previous stages.

Problem solving actions involve implementation of plans which may or may not lead to successful resolution of the problem. Failure to solve the problem may again be due to a failure at one of the previous stages, or a failure to successfully implement plans, although they might have been adequate. ***Evaluation*** is the last important step and involves the evaluation of the solution offered for flaws.

It has also been established that personality factors are important determinants of problem solving behaviour, and therefore it is imperative that it be determined which personality factors contribute to the successful execution of certain tasks. For example, it has been established that the dimension introversion/extraversion is related to both cognitive style, learning style and problem solving (see chapter 3, 4 and 5); Heppner and Krauskopf (1987) cite social responsiveness or social intelligence as an important variable in problem solving, especially tasks involving interpersonal problem solving. Other important personality variables are locus of control (see Rotter, 1967), dogmatism or degree of openness or closedness of an individual's belief system which limit the individual's cognitive processes such as inference making (see Tobacyk & Milford, 1982), positive affect (including self-esteem, optimism, and narcissism) and negative affect (including fearfulness and emotionality) (see Wolfe & Grosch, 1990). Cultural and educational factors are also important variables affecting the use of problem solving strategies (see Okonji, 1969; Okonji, 1980; Wood, 1978).

It has been shown that unsuccessful learners and problem-solvers do not spontaneously apply task-appropriate strategies on a metacognitive level, that is, they are less competent at successfully undertaking a task; have problems with planning effective organizational schemes for approaching tasks; do not effectively monitor their progress or understanding of the task; have problems with identifying and correcting errors as they proceed with the task; and do not effectively evaluate their performance at task completion (Loper & Murphy, 1985). Depending on the type of problem, many other problem solving activities may be involved. It is not possible to specify these without specifying the exact problem space.

2.5 SUMMARY

Developments in cognitive theorizing have important implications for research into cognitive styles. Many of the research findings regarding information processing, metacognition and problem solving can be fruitfully applied to the study of thinking styles.

It is recommended that cognitive style theorizing and instrumentation, with the focus on the "how" of thinking instead of how much of an ability an individual possesses, should also focus on factors other than those which are purely cognitive by nature, such as personality variables. Many theorists regard cognitive style as part of personality organization and as such these variables cannot be ignored.

3.0 THE CURRENT STATUS OF COGNITIVE STYLE THEORY AND RESEARCH

Thus far we have focused on general theories of intelligence and how the concepts advanced by these can be used to further enquiries into cognitive styles. In this chapter we will concentrate on cognitive style theory and research. Cognitive styles are manifestations of individual differences in the execution of cognitive tasks. An evaluation of the theoretical basis of cognitive styles, as well as an assessment of the measurement instruments used to demonstrate the validity the theoretical assumptions made regarding these, are important for further theorizing, research and instrumentation, as will be seen from the discussion of the various instruments currently in use to assess cognitive styles.

In the last part of this chapter we will take a look at the integrative theory of personality and cognitive styles as conceptualized by Royce and his associates, as well as the cognitive style theories of Kirton and Churchman, both of which make use of self-report inventories to assess cognitive styles.

3.1 CHARACTERISTICS OF COGNITIVE STYLES

From the cognitive styles literature it is apparent that different theorists define styles differently. In this section an overview of these will be presented. The term "cognitive style" originated in personality research (Green & Schroeder, 1990) and occupies a middle ground between aptitude measures and personality measures (Baron, Badgio & Gaskins, 1986).

Before proceeding further, it is essential to distinguish between cognitive abilities and styles. Abilities refer to cognitive capabilities underlying performance on tasks measuring a variety of abilities, emphasizing maximum performance, with a value judgment according to how much of an ability an individual possesses. Styles, on the other hand, refer to a ***typical and preferred mode employed spontaneously to process information***, with individual differences in the methods of achieving a ***constant*** level of competence. The major difference is that the former is concerned with level of performance, while the latter focuses on the manner of performance. This is the first criterion of "pure" cognitive style to which the theoretical definition of a style, as well as the instruments used to assess that style, should comply. No reference to the individual's ability for the task (which may be minimal) should be made, thus ***signifying***

the absence of value judgements, that is, one mode of processing should not be judged to be superior to another; instead, circumstances determine which style is more appropriate to use. Ability measures are value-directional, that is, having more of an ability is better than less, while style measures are value-differentiated, with each extreme of a specific style having adaptive value but in different circumstances, depending on the situation and the cognitive task requirements. This is the second criterion posed for pure cognitive style measures (Baron *et al*., 1986; Cohen, 1983; Green & Schroeder, 1990; McKenna, 1984; Tiedemann, 1989).

Scales measuring abilities are unipolar, while cognitive style measures are ***bipolar***, ranging from one extreme to a contrasting extreme with each end of the dimension having different implications for cognitive functioning. These scales, therefore, have a ***broader range of application*** than ability measures, and cut across ability and other cognitive, personality and interpersonal domains. These constitute the third and fourth criteria for pure cognitive style measures (McKenna, 1984; Tiedemann, 1989). Furthermore, abilities are called enabling variables since they facilitate task performance and styles are seen as ***organizing and controlling variables*** in the sense that these variables contribute to the selection, combination and sequencing of both substance and process (organization) and help to regulate the direction, duration, intensity, range, and speed of functioning (control) (Tiedemann, 1989).

Two other classes of cognitive styles are identified by McKenna (1984), the first being similar to the measurement of abilities in that assessment is executed in terms of accuracy of performance. It is advisable that the term cognitive style not be used in relation to these measures and they will not be considered in this report. The second class is closer to the pure cognitive style domain and uses a bipolar scale, although functioning at one end of the dimension is regarded as superior to functioning on the other end. These styles are value-directed which makes them questionable. In this report the most important cognitive style dimensions will be discussed in terms of McKenna's classification: Class 1 styles which are those that resemble cognitive styles because of the bipolarity of the scales but which are actually value-directed; and Class 2 styles which are those that theoretically and empirically satisfy the abovementioned criteria. The styles which are assessed through the use of self-report instruments will be discussed at the end of this chapter.

Cognitive style measures resemble both cognitive and personality measures, the former because of the focus on attention, perceiving, memory and processing, and the latter because the concern does not end with the limits of performance. What distinguishes cognitive style measures from ability and personality measures is that while ability measures focus on the product of a test and personality measures are usually of the self-report questionnaire type, cognitive style measures focus on habitual behaviour which frequently involves laboratory tasks (although self-report instruments are also used) to facilitate the discovery of relatively permanent and dominant ways of approaching, encoding and processing information (Baron *et al.*, 1986; Melis, 1981 in Kotzé, 1985). Although it is easy to distinguish between personality and cognitive style measures, theoretically the two concepts are similar. Cognitive styles are considered to be ***dimensions of personality organization*** by many cognitive psychologists. The description of a cognitive style, thus, provides personality descriptions (Carey, Fleming & Roberts, 1989; Okonji, 1980; Tiedemann, 1989; Wardell & Royce, 1978). In this regard, of noteworthy importance is Royce's theory (discussed in section 3.5). Cognitive style according to this view is defined as "a multidimensional, organized sub-system of processes ... by means of which an organism manifests cognitive and/or affective phenomena", which consistently influences the manner of cognitive and affective processing (Wardell & Royce, 1978, p. 475). Thus, cognitive styles are regarded as stable higher-order traits since they influence the manner in which cognitive abilities and affective traits are related to individual behaviour.

Vernon (1984) holds the opinion that cognitive styles resemble the historical notion of types and therefore have weak internal consistency and generalizability except in cases where styles are defined in terms of psychometric variables or factors. Adopting a psychometric standpoint, however, does not satisfy the criteria for cognitive styles and only transports us back to the original problems experienced with the interpretation of psychometric data as indicators of different cognitive styles.

Some theorists add another feature to cognitive styles, seeing them as ***stable over time*** (Okonji, 1980), a view which is not consistently held. Cognitive styles are seen as permanent dispositions (fixed traits rather than stable states) which can be conceptualized as the product of intelligence and personality factors, as well as enduring cultural and educational influences. While personality and cognitive styles are seen as very stable and resistant to change, strategies and personal knowledge structure are viewed as the least stable and most changeable (Van der Veer, 1989). A view which is more in line with the conceptualization of cognitive styles, by the author, is that rather than being fixed modes of functioning, cognitive styles are dependent upon what the individual is thinking about or the task confronting the individual. This means that cognitive styles are dependent upon three factors, namely the individual, the situation (or domain of thought), and an interaction between these two (Peterson & Scott, 1975). It is not recommended that cognitive styles be regarded as completely stable or unchangeable, because individuals accommodate themselves according to the demands of the task they are presented with.

3.1.1 Definition of Cognitive Style

Resulting from the above discussion the following definition of cognitive style is proposed:

Cognitive style, being part of personality organization, represents a characteristic mode of information processing which involves a constellation of metaprocesses. Cognitive styles, then, are stable individual preferences regarding the manner of perceptually organising and conceptualising the environment as well as reacting thereon or adapting thereto.

The above definition of cognitive style demonstrates that it can, in a way, be equated to a typology. According to the criteria set out in the previous section individuals can be classified in terms of the type of cognitive approach or style he or she prefers in approaching and solving problems.

3.1.2 Assessment Instruments

There are certain criteria that the measurement instruments used to assess cognitive style should meet, apart from those already discussed, namely:

1. The subject must have the necessary ability to find the solution. This means he or she must understand the problem and believe that a solution can be attained.
2. Potential answers must appear to be of equal value or equally attractive to the subject.
3. Subjects must feel relaxed during the testing procedure (Tiedemann, 1989).

The most important criterion is that the results of the assessment should point to process or strategic differences with ability being constant for both ends of the dimension.

3.2 CLASS 1: COGNITIVE STYLE OR COGNITIVE ABILITY?

As has been explained in section 3.1 class 1 styles are those that resemble cognitive styles because of the bipolarity of the scales but which are value-directed. Functioning at one end of the dimension is regarded as superior to functioning at the other end. Baron *et al.*'s (1986) normative approach to cognitive style measures fits well into this class. According to this approach, styles are regarded in terms of "the magnitude and direction of departure from the optimum on a certain dimension" (p. 173). Optimum is defined as a model of performance outlining what an individual should do to execute a task successfully. A style is regarded as nonoptimal when training changes the style as well as improves performance (see section 3.4.4). Tasks are set up in a manner that allows for a optimum style to be defined and the deviation from the optimum to be measured.

This conceptualization of cognitive style involves a focus on skill as well as on the manner of performance. For the purposes of diagnosis and training individuals to use more effective styles for problem solving, this approach is commendable. Baron and his colleagues regard the normative approach as applicable to almost any style, if the above perspective is used.

3.2.1 Reflection versus Impulsivity

A discussion of reflection/impulsivity, one of the most researched styles, necessitates substantial space in any presentation of cognitive style research. This is a dimension of individual differences in style of performance when tasks involving response uncertainty are considered, that is, when several possible alternatives are available and the correct alternative is uncertain, specifically referring to the trade-off between speed (or conceptual tempo) and accuracy, which is concerned with the degree of reflection over alternative response possibilities.

Reflective subjects are more concerned with accuracy and less with speed and therefore respond slower but make fewer mistakes, while impulsive subjects respond quickly but are less concerned with accuracy and therefore make more errors. Impulsive subjects demonstrate minimal reflection and very little critical evaluation of alternatives. Also located on the same dimension are those subjects classified as fast-accurate (short response latencies and low error rates) and slow-inaccurate (long response latencies and high error rates) (Baron *et al.*, 1986; Kagan, Pearson & Welch, 1966; Kagan, Rosman, Day, Albert & Philips, 1964; Kotzé, 1985; Messer, 1976).

Baron *et al.* (1986) regard the reflection/impulsivity dimension as located on one continuous scale, with fast-accurates and slow-inaccurates located in the middle of the dimension. However, Kagan's (1976, in Taylor, 1987) view seems more appropriate, viewing reflection and impulsivity as located on two dimensions. Figure 3.1 is a graphic representation of the reflection/impulsivity dimension, seen as two dimensions forming four quadrants or possible styles:

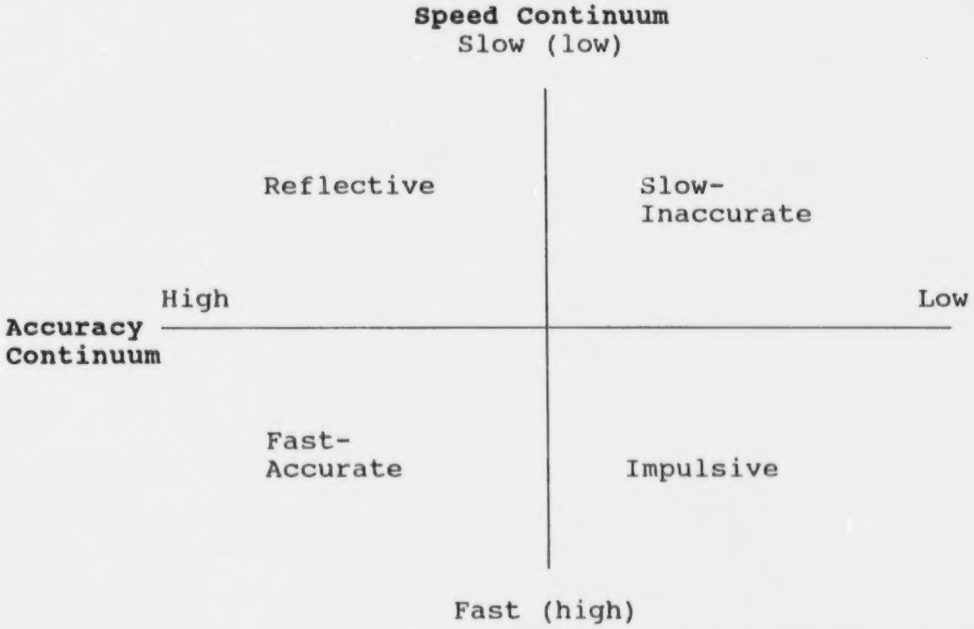


FIGURE 3.1: A GRAPHIC REPRESENTATION OF THE REFLECTION/ IMPULSIVITY DIMENSION OF COGNITIVE STYLE

Reflection/impulsivity is viewed as a relatively stable trait with a broad range of applicability as has been demonstrated in several research studies which include tasks requiring reading, verbal and nonverbal reasoning (Baron *et al.*, 1986), inductive reasoning (Kagan *et al.*, 1966), and convergent reasoning. Klein and his associates (Klein, Blockovich, Buchalter & Huyghe, 1976) found no relationship with divergent thinking and therefore concluded that divergent thinking is independent of this dimension. Researchers associate learning problems with impulsivity (Kotzé, 1985), as well as a less advanced problem-solving approach, a lack of task persistence and certain classroom behaviour problems (Kendall, Pellegrini & Urbain, 1981).

The tendency towards reflection or impulsiveness is manifested at a very early age (6 years). Baron *et al.* (1986) report on the findings of Ault (1973) which concluded that reflection is a function of development and that impulsivity declines with age. Therefore, rate of development may be an important mediator of performance.

Measurement instruments: The Matching Familiar Figures Test (MFFT), developed by Kagan and his colleagues, is the most frequently used for the assessment of this style - one of the few styles operationally defined by paper-and-pencil tests - most other styles are measured by the use of laboratory tests (Tiedemann, 1989). However, the MFFT, as a measure of cognitive style, is criticised extensively because of methodological problems which include low reliability of error scores, a moderate negative correlation between latency and error scores, and poor consistency in classification of individuals as impulsive or reflective, especially with respect to the impulsive end of the continuum (Ault, Mitchell & Hartmann, 1976; Kendall *et al.*, 1981; Solís-Cámara & Solís-Cámara, 1987). Furthermore, the results of Zelnicker and Jeffrey's (1976, in Baron *et al.*, 1986) research indicate that the MFFT, rather than being a sufficient measure of this dimension, tends to measure a preference for an analytic strategy. Another important shortcoming of the MFFT is that it does not point to strategic or process differences in information processing. Given these shortcomings, a reinterpretation of results is needed and this should be borne in mind when considering the research findings reported here (most of which were based on use of the MFFT). Furthermore the MFFT conceptualization of impulsivity, which represents a behavioural measure of impulsivity, does not correspond to other measures of this variable, for example self-report questionnaires, which point to a problem in the operationalization of the construct (see Gerbing, Ahadi & Patton, 1987).

Characteristics associated with reflection and impulsivity. Differences between reflective and impulsive subjects have been attributed to variables of a cognitive and personality nature, the major area of difference being cognitive, that is in executing tasks involving response uncertainty. Reflective and impulsive subjects differ markedly with respect to feature analysis. These tasks involve four processing stages: encoding, comparison (a stage of which feature analysis forms part), response-selection and response-execution. It has been established that impulsive subjects spend less time and are less active than reflective subjects with the analysis and evaluation of stimuli (Kagan *et al.*, 1966). Reflective subjects not only gather more information on stimuli used to make decisions but also do so more systematically, while impulsive subjects follow a less systematic and more global approach. This finding holds for both children and adults (Messer, 1976). This represents a qualitative difference (a difference in the thoroughness with which stimuli are analyzed) rather than a process difference, as no differences in respect of the encoding and comparison process were found (Klein *et al.*, 1976). Both children and adult impulsive subjects do not adjust their response latencies when the number of alternatives increase thereby indicating that they tend to respond after a certain time period has elapsed, regardless of attainment of a problem solution. This, according to Kendall and Hollon (1981a), suggests a temporal problem since impulsive subjects consistently underestimate time.

Differences in information processing among fast-accurate, reflective, impulsive and slow-inaccurate subjects have been studied by Ault, Crawford and Jeffrey (1972). They found that in comparison to the other groups fast-accurate subjects focus on less stimuli but concentrate longer on the comparison of a few pairs of stimuli so that they achieve both speed and accuracy. Reflective subjects are the most cautious, sacrificing speed for accuracy. These researchers concluded that the four groups do not differ in their basic scanning strategies; rather reflectives and fast-accurate subjects are more systematic in their scanning strategies, which represents a skill rather than a style difference.

Although differences between reflective and impulsive subjects in preferred perceptual processing strategy, that is global versus analytic processing, have been found, with reflective subjects following a more analytic approach and impulsive subjects following a more global approach when executing certain classification tasks (see Messer, 1976; Smith & Kemler Nelson, 1988; Zelniker & Jeffrey, 1976; Zelniker, Renan, Sorer & Shavit, 1977), it would be erroneous to conclude that impulsive subjects are simply more global processors on the basis of this finding. Taking just such a stand, Zelniker *et al.* (1977) suggest that problems can be made more compatible to impulsive subjects' preferred processing strategy to improve their performance. The value of this suggestion is questioned when other research results are taken into account. In contrast to Zelniker and Jeffrey's (1976) interpretation that impulsive subjects should perform better than reflective subjects with global processing tasks, since the latter prefer part-scanning strategies, the existence of such a relationship was not demonstrated by subsequent research. Using tasks that encourage a holistic processing approach (for example, the Color Matching test) Smith and Kemler Nelson (1988) found that impulsive subjects did not perform as expected, that is, they did not perform better or even as well as reflective subjects. Therefore, these researchers concluded that impulsive subjects process information both more holistically, preferring a whole-scanning approach to a detail-scanning approach **and** less adequately, which account for their poorer performance on tasks that encourage holistic processing. Thus, holistic processing is viewed as the result of an impressionistic, less effortful cognitive approach which broadly characterizes the impulsive subject.

A relationship was found between a preference for analytical concepts and reflection and a preference for relational concepts and impulsiveness. Using the MFFT, Kagan *et al.* (1964) classified subjects as reflective or impulsive, after which they were required to perform a classification task. Reflective children were found to produce more analytic responses than impulsive children. These researchers concluded that conceptual tempo is a prerequisite for an analytical style, since instructions to respond slower elicited more analytical responses from non-analytic children, but instructions to respond faster did not elicit less analytic responses from analytic children. This relationship is, however, not well established since other investigators have failed to replicate Kagan *et al.*'s results (see Messer [1976] for a review of these studies).

Baron *et al.* (1986) report on studies in which a relationship between dimensional classification (versus overall similarity) and reflection (versus impulsivity) was found in adult samples. Results for samples consisting of children were inconclusive. This may be due to developmental factors, namely that children are unable to make dimensional classifications which render such enquiries irrelevant.

The relationship between field-dependence/independence and reflection/impulsivity has also been reported in numerous studies with a moderate association between reflection and field-independence and impulsiveness and field-dependence (for a review of the literature see Messer, 1976). For example, Neimark (1975) found that those subjects who were both reflective and field-independent were the most successful problem solvers.

All the research findings outlined above, as well as other empirical studies not mentioned, seem to emphasize one point very clearly: it is far better to be cognitively reflective than impulsive. For example, impulsivity correlates negatively with IQ tests (which reflect a combination of accuracy and speed) and school performance (see Messer, 1976 for a review of the literature), supporting Thurstone's (1924, in Taylor, 1987) view that the key aspect of intelligence is the inhibition of impulsiveness, or the ability to consider and evaluate alternatives without implementing them. Further support for the superiority of reflectiveness was found in research on learning, with reflective or analytic learners being more effective learners than impulsive or global learners (see Kagan, 1966, in Doyle & Rutherford, 1984). Reflective children employ better problem-solving strategies when faced with tasks with response uncertainty (serial learning tasks, visual recognition tasks, concept attainment tasks, and Porteus maze problems), as demonstrated by the research reviewed by Messer (1976).

Research also demonstrated that reflective children possess a more mature level of speech, verbalizing more and using more self-guiding private speech than impulsive subjects who were found to use more egocentric speech (Meichenbaum, 1971 in Messer, 1976). As far as adult speech, and specifically spontaneous self-talk, is concerned, Kendall, Hooke, Rymer, and Finch's (1980) research demonstrated that adult impulsive subjects exhibit less "thinking out loud" behaviour than reflective subjects and, furthermore, impulsive subjects working on a questionnaire endorsed those items that were indicative of motivation for speed rather those indicative of motivation for success. This verbal behaviour, according to Kendall and Hollon (1981a), supports the notion that cognitively impulsive adult subjects have a task-strategy deficit. It is, however, necessary to keep in mind the problems associated with recording speech, especially as it relates to covert speech. Many factors can inhibit subjects from verbalizing inner self-talk; self-talk may even be automatic and may not be verbalized on an inner level.

The one exception to the abovementioned findings concerns creativity. The existence of a relationship between impulsivity and divergent thinking was postulated since a relationship has been established between creative problem-solving and divergent thinking. This means that impulsive subjects should be more creative than reflective subjects. Research results, however, do not support this assumption (see Garrett, 1989; Klein *et al.*, 1976). The only study demonstrating a relationship between impulsivity and creativity was the rather unusual study of Duemler and Mayer (1988).

Even though most research studies demonstrate the advantages of reflective thinking, Duemler and Mayer (1988) question this view, especially the implications it holds for remediation of impulsivity and reflectivity training. They specifically question Baron's (1985) view that a linear relationship exists between reflectivity and creative problem solving, that is, that the more reflective an individual is the more successful he or she would be with creative problem solving. To validate this assumption these researchers carried out an investigation using only impulsive and reflective subjects who were successful problem solvers. Their finding that a U-shaped relationship exists between successful problem solving and reflection/impulsivity is very enlightening: subjects who were successful conventional problem solvers and who were either extremely reflective or impulsive performed worse than moderately reflective or impulsive subjects on solving unconventional problems. They explain their findings in terms of hypothesis generation-styles: extremely successful conventional problem solvers' hypothesis generation is restricted to conventional hypotheses; subjects who are extremely unsuccessful on conventional problems search for too many irrelevant unconventional hypotheses and their hypothesis-testing styles are unsystematic; and subjects who are average on conventional problem solving perform the best on unconventional problem solving because their hypothesis-generation styles enable them to generate unconventional hypotheses while they are able to systematically evaluate these. Duemler and Mayer (1988), therefore, warn that training impulsive subjects to be more reflective should be two-fold, i.e. teaching systematic hypothesis testing without eliminating creative hypothesis generation.

Emotional factors are also linked to reflection/impulsivity. Certain research studies indicate that anxiety over failure is a factor in reflection - the reflective subject is more concerned about the quality of his solution than the impulsive subject (Messer, 1976; Zelnicker & Jeffrey, 1976). Other studies have failed to replicate this relationship (see Kagan, 1966). Another emotional factor which is related to this style is motivation. Baron *et al.* (1986) propose that individual differences in motivation may be an important determinant of individual differences in reflection/impulsivity, a hypothesis which needs further exploration. Global self-concept is also viewed as an important determinant of this style and it was demonstrated that individuals viewing themselves as competent are more inclined to be careful problem solvers (Armstrong & McDaniel, 1986). These researchers conclude that self-perception of competency in problem solving is an important part of metacognition.

From the literature it is apparent that a host of negative characteristics are associated with impulsivity which is unfortunate from a style perspective. These include educational deficits, inadequate motivation, certain clinical syndromes, deviant social behaviour and aggressiveness (see Bernfeld & Peters, 1986; Messer, 1976). Bernfeld and Peters (1986) concluded from their research that impulsive subjects do not have social cognitive skill deficits but production deficits (i.e., low motivation) and control deficits (i.e., impulsive functioning) which contribute to their deviant social behaviour and aggressiveness.

As far as *personality factors* are concerned, Gerbing *et al.* (1987) investigated the relationship between cognitive impulsivity and measures of impulsivity as a personality trait, included in many personality questionnaires. Only moderate to low and negative correlations between behavioural measures such as the MFFT and self-report measures of impulsivity were found. This led them to conclude that different constructs are measured by the different instruments and that a coherent framework does not exist from which to conceptualize impulsivity.

Some investigators have linked the introvert/extravert dimension to reflection/impulsivity, with introverts opting for accuracy and extraverts opting for speed, but other studies have failed to demonstrate a definite relationship. Weinman, Elithorn and Cooper (1985) found a relationship between the speed continuum of reflection/impulsivity (in solving maze problems) and introversion/extraversion, especially with regard to the search phase, with extraverts using the least time. They also found a correlation between slow performance and neuroticism. A relationship between extraversion/introversion and strategy choice and error patterns was not demonstrated. In another study using maze problems, Weinman (1987) found that extraverts used an impulsive exit strategy and solved less mazes correctly than introverts. No relationship between rigidity or neuroticism and style of performance was found in this study. Again, it was concluded that personality factors are predominantly related to cognitive tempo in these type of tasks with no significant links to accuracy.

Training and remediation. It is necessary to consider the negative consequences of impulsivity for information processing and therefore the fact that the modifiability of impulsivity has been demonstrated in many studies is encouraging. One of the major problems demonstrated by impulsive subjects is that information is scanned and gathered ineffectively and extensive encoding does not take place (Taylor, 1987), which negatively affect all the following stages of problem solving resulting in poor performance. In section 3.4 a discussion of cognitive style training is presented, using reflection/impulsivity as an example.

Conclusion. Reflection-impulsivity cannot be regarded as a pure cognitive style, since this style does not meet all the criteria for style measures. Firstly, this style is value-directed with impulsivity regarded as inferior to reflection and many cognitive and behavioural problems associated with impulsivity. Even though the scale is bipolar and the manner of performance is taken into account when assessing this style, theoretically and empirically it does not satisfy the criteria for pure cognitive styles. This places reflection-impulsivity closer to the ability domain. Reflection may even be regarded as a skill or strategy rather than an ability. Theoretically, the definition of impulsivity leaves much to be desired, and it is necessary that the conceptualization of the construct be made more explicit. To acerbate matters, the MFFT as measure of reflection/impulsivity has many shortcomings and resembles an ability measure rather than a style measure, the focus being on the product of performance rather than the processes involved. It is advisable that a new measure of this dimension be devised which is free of the methodological problems experienced with use of the MFFT.

3.2.2 Cognitive Flexibility versus Cognitive Rigidity

Flexibility/rigidity is a bipolar dimension of individual differences in the style of problem solving, where flexible behaviour is regarded as being superior to rigid behaviour. Goldner's (1957) definition of flexible thinking includes both variety and variability of behaviour. Variability (or behaviour free from perseveration) means that a subject should be able to find new ways or different strategies of approaching a problem solution when his original approach was unsuccessful to bring about the desired result, while variety indicates the ability to find several possible solutions to the problem. Thus, while flexibility indicates the ability to restructure information in a novel manner, rigidity is not characterized by either variety or variability even if it is possible or required to solve a problem.

According to Stager and Leithwood (1989) motivation is an important construct in flexibility/rigidity, since motivation is the product of an individual's personal goals, mood states and the current knowledge one has regarding the problem to be solved. All of these, mediated by a person's thinking processes, contribute to the problem solving approach used.

Characteristics associated with flexibility and rigidity. This style is important as far as practical intelligence and strategic decision making is concerned (see Stager & Leithwood, 1989). The characteristics of a flexible approach to problem solving include the following (see Goldner, 1957; Stager & Leithwood, 1989):

1. Adjustment of interpretation and approach according to situational features, or recognizing novel aspects of a problem *(versus the use of a favourite attack even when problems differ and/or being unresponsive to situational differences)*;
2. Actively controlling one's thoughts, moods and plans *(versus little active control over moods and thoughts)*;
3. The production of multiple alternatives for the interpretation of a single situation or problem *(versus limited production of responses)*, including:
   a high degree of readiness to discard responses made and to seek novel

responses *(as opposed to perseveration, or persistence in giving the same response which is indicative of an inability to restructure the problem and of inactivity in problem solving. Attempts to generate novel responses, but always returning to the original response, are also regarded as rigid behaviour)*;

4. Active and extensive manipulation of problem material *(versus the absence or restriction of manipulation of problem material)*;
5. Changing one's knowledge repertoire by the addition of new experiences and changing or adapting cherished beliefs, values, and goals *(versus fixed schemas in the knowledge base which are resistant to change)*;
6. Changing the conceptual situation (using a conceptual approach) by using various strategies, for example setting up hypotheses to be verified later *(versus lack of a conceptual approach)*;
7. Adequate exploration of the problem *(versus inadequate exploration)*;
8. Organized problem solving behaviour *(versus the presence of fluid, unorganized behaviour, that is jumping from one aspect to another or verbalizing confusion or fluidity)*.

The actual task requirements of any particular problem solving exercise will, however, determine the specific definition of flexibility/rigidity.

Stager and Leithwood's (1989) research on problem solving of elementary school principals reveal certain differences between flexible and rigid problem solvers, involving cognitive errors, mood related problems, and problems regarding practical intelligence, summarized in Table 3.1. These researchers also found that level of expertise is related to flexible problem solving, with the more expert subjects being more flexible problem solvers. This indicates the value of training and education for flexible problem solving.

Goldner's (1957) research, which includes both structured and unstructured tests, reveals a moderate degree of consistency in flexibility/rigidity, although being flexible or rigid in one testing situation does not predict flexibility or rigidity in the other situation, which repudiates the notion that a general flexibility/rigidity factor exists. Rather, this research demonstrates that flexibility/rigidity is situation specific. This finding supports Wand's (1958, in Taylor, 1987) study which used a variety of measures of different types of rigidity and found no evidence for a general rigidity factor.

Conclusion. From the definition and description of this dimension it becomes apparent that although this is a bipolar dimension and although there is a focus on the processes involved in problem solving, it involves value-directedness, since being a flexible problem solver is obviously better than being a rigid one, and would enhance successful and creative problem solving. Flexibility/rigidity is therefore not theoretically or empirically regarded as a pure cognitive style, just as is the case with reflection/impulsivity. Still, an important goal in thinking skill training would be instruction in flexible thinking and problem solving.

TABLE 3.1: CHARACTERISTICS OF FLEXIBLE VERSUS RIGID PROBLEM SOLVERS AMONG ELEMENTARY SCHOOL PRINCIPALS

FLEXIBLE PROBLEM SOLVING	RIGID PROBLEM SOLVING
The use of deliberate planning and priority setting and a focus on the overall picture.	Overweigh vividness in setting priorities.
Encourage collective work from all individuals involved.	Focus on contributions of a small or biased sample.
Aware of uniqueness of situations, being alert for dangers and being conscious of particular features of situations.	Fail to see uniqueness or difference of situations from those in the past.
Deliberate awareness of need to search for and analysis of real causes of problem.	Fail to determine actual causes of problems; being superficial.
Know that new problems exist and can identify these.	Fail to see new problems because of overreliance on familiar theories and beliefs.
Conscious awareness of need for variability and flexibility in strategies and roles.	Fail to modify an approach or strategy in light of specific situational features; stuck on an approach useful in many situations, without regard for situations in which this is inappropriate.
Awareness of individual differences and hold theories that encourage flexibility and openness.	Stereotyping (staff members) and holding rigid theories not accurately representing reality.
Recognition of own limits regarding ability to solve problems.	Fail to examine alternative courses of action.
Conscious control of mood.	Focus on own negative mood.
Take advantage of opportunities as they present themselves.	Miss opportunities.
Attentive and observant regarding opportunities to meet goals.	Fail to notice other possible courses of action; blind to possibilities because of narrow goals.

3.2.3 Analytical, Inferential and Relational Styles

Analytical, inferential and relational styles refer to classification styles. Individuals with a preference for analytical classification group objects on the basis of similarity of objective physical attributes, forming analytic-descriptive concepts; those preferring inferential classification group according to common category membership, forming inferential-categorical concepts; and those preferring relational classification group objects according to functional relationships among stimuli, forming relational concepts. Kagan, Moss and Siegel (1963, in Baron *et al.*, 1986) regard analytic classifications as most mature and relational classifications as least mature. However, from a style perspective, it would be better to regard style of classification as situation-dependent, using the nature of the task-requirements to decide which is the appropriate style. Since Kagan *et al.* (1964) are adamant that an analytical style is superior, these styles are included with Class 1 styles as value-directed.

Characteristics associated with analytic, inferential and relational classification styles. Kagan *et al.*'s (1963, in Baron *et al.*, 1986) research indicates that individuals preferring analytic classifications are also concerned with intellectual mastery, independence and achievement motivation. A negative correlation between an analytic orientation and impulsiveness and uncontrolled motor behaviour was found in children. When interpreting ink blots, the analytic subjects use highly differentiated and descriptive references, while the other subjects use more indistinct percepts. On the basis of their research data, Kagan *et al.* (1964) associated an analytic style with high performance on a variety of intellectual task requirements, which included the interpretation of ink blots, picture arrangements and the production of word associations. No correlation with vocabulary level was found. Based on these findings Kagan *et al.* (1964) regard an analytic style as the most mature style, being associated with reflection. The relational style is associated with impulsivity.

3.2.4 Cognitive Complexity versus Cognitive Simplicity

The use of the term cognitive complexity includes more than one interpretation of which cognitive process is being referred to. In reviewing the literature, it became apparent that this dimension refers to individual differences in a variety of cognitive constructs, such as cognitive differentiation, articulation, integration and flexibility, indicating that this dimension consists of more than one theoretical dimension. Cognitive complexity does not refer to a detailed cognitive structure; rather the distinction refers to the use a person makes of his cognitive structure and the sophistication of this structure in information processing, especially when using evaluation and judgement processes (Goldsmith, 1986).

Cognitively complex individuals make complex differentiations by using the processes of analysis, abstraction, construction and integration of concepts, as well as cognitive articulation (the number of levels of attributes used in the evaluation of objects) and cognitive integration (the organizational complexity of cognitive dimensions). A cognitively complex person is therefore also very flexible (see Goldsmith, 1986; Tiedemann, 1989; Wardell & Royce, 1978).

Conceptual differentiation. Conceptual or cognitive differentiation, sometimes viewed as an aspect of cognitive complexity and sometimes as a separate cognitive style, refers to "the process of bringing a large number of concepts to bear on cognitive tasks" (Wardell & Royce, 1978, p. 478). It is assessed by using object sorting tasks, with a focus on individual differences in the number of differentiations or conceptual discriminations made among dissimilar particulars. The dimension is value-directed. Individuals who pursue detailed conceptualizations are seen as more conceptually differentiated.

Conceptual integration. Conceptual integration, also sometimes seen as an aspect of cognitive complexity and sometimes as a separate cognitive style, refers to the tendency to explore and develop relationships among concepts (Wardell & Royce, 1978). This dimension is also value-directed, with higher conceptual integration regarded as the more advanced style.

Measurement instruments. The measurement of cognitive complexity is not an easy task, since the same instrument cannot be used to measure all the aspects thereof. Furthermore, the weight of the empirical evidence indicates that the operationalizations of the different interpretations of cognitive complexity are unrelated (O'Keefe & Sypher, 1981, in Goldsmith, 1986).

The instruments currently used to assess cognitive complexity are Kelly's Role Construct Repertory Test, an instrument assessing social behaviour, and a projective sentence completion test. Performance measures are not used. Many problems dealing with the reliability and validity of these instruments have been cited in Tiedemann (1989). It is obvious that cognitive complexity cannot be regarded as a cognitive style measure, since this dimension is unipolar and value-directed.

Interventions are aimed at increasing cognitive complexity, regardless of the situational and task demands (McKenna, 1984; Tiedemann, 1989).

3.2.5 Category Width

Category width or equivalence range refers to categorization style, that is broad versus narrow categorizing, or the degree to which individuals act on or ignore an awareness of differences. Narrow categorizers use exact standards for judging similarity and tolerate errors of exclusion in categorizing, while broad categorizers ignore fine stimulus differences, use inclusive categories and tolerate errors of inclusion.

Several assumptions relating to this dimension are made. It is assumed that broad categorizers view their environment broadly while narrow categorizers have a narrow perspective of the environment. A second assumption is that category width reflects quantitative aptitude, which was shown to be the case in the research of Pettigrew (1958, in Tiedemann, 1989). This assumption is based on the measures used to determine category width, namely Pettigrew's Category Width Scale, and Fillenbaum's Range Width Test. Messick and Kogan (1965) investigated whether the quality of performance on a test of quantitative aptitude is affected by categorization style. The assumption was that broad categorizers would have an advantage over narrow categorizers since the former would be able to estimate answers faster, while the latter would be more concerned with accuracy, which was supported by the results of their investigation.

Tiedemann (1989), however, cites numerous problems associated with all the measures employed to assess this dimension. Not much empirical evidence of this concept as a pervasive construct cutting across ability, cognitive and personality domains exists. It could not be shown that this dimension is related to any specific personality concepts. All that has been demonstrated conclusively is that category width is related to quantitative aptitude.

3.2.6 Abstract versus Concrete Thinking

The dimension abstract versus concrete thinking refers to individual differences in the preferred level of and capacity for abstraction. An individual who is adept at abstract thinking manifests a preference for concept formation and the manipulation thereof, uses more information, attends to different kinds of information and uses more strategies than the concrete thinker in concept formation and problem solving. The more concrete the thinker the more information is treated and used according to the physical attributes thereof (Wardell & Royce, 1978).

Farnsworth and Mayer (1984) have shown that students high in abstract thinking learn formal concepts with greater understanding and have higher levels of achievement than those students who are concrete in thinking. A follow-up study also found that the achievement levels of abstract thinkers were sustained which was not the case for concrete thinkers. This type of study, however, refers to cognitive structures dependent upon development of mature cognitive structures, rather than process differences between abstract and concrete thinkers which exclude this dimension from pure cognitive style dimensions.

3.3 CLASS 2: PURE COGNITIVE STYLE DIMENSIONS

In this section style dimensions that satisfy the criteria for pure cognitive styles are discussed. Briefly, the criteria include (1) bipolarity of the dimension, (2) indicating typical and preferred modes of information processing with reference to process differences in information processing, (3) these modes being value-differentiated, meaning that both ends of the dimension have strengths and weaknesses, and (4) the dimension having a broad range of application cutting across ability, cognitive, personality and interpersonal domains.

3.3.1 Field-dependence versus Field-independence

Witkin formulated the well-known theory of field-dependence/independence, one of the most extensively researched styles, which is conceptualized as a dimension of cognitive style reflecting different levels of differentiation of psychological functioning. According to this theory high levels of differentiation characterize field-independence and lower levels of differentiation characterize field-dependence. This dimension relates to manner of perception or more specifically, the degree to which the surrounding field (background) influences what is being perceived (foreground or figure). A global mode manifests at the field-dependent end of the continuum and an articulated mode at the field-independent end (Goodenough, 1976; Hansson, Rydén & Johnsson, 1986; Karp, 1963; Kotzé, 1985; Okonji, 1980; Zoccolotti & Oltman, 1978).

The organization of the perceptual field governs experiences for field-dependent individuals, with the result that they adhere to this organization with little analysis of and without restructuring the field. On the other hand, field-independent individuals tend to analyze and restructure experience and to isolate components from its context to use in other contexts on a perceptual and intellectual level. Thus, this style involves the ability to overcome the embeddedness of contexts with those individuals having higher levels of differentiation (greater segregation and specialization of different functions) demonstrating higher levels of this ability.

Field-dependence/independence is regarded as relatively stable until adulthood when it becomes absolutely stable (Witkin, 1967 in Okonji, 1980). Furthermore, many investigators found that inducing a change in this style was almost impossible (see Okonji, 1980). This, however, cannot be taken as an absolute since Mykytyn (1989), after investigating learning effect differences using finance specialists as subjects, found that the one demographic characteristic which showed a relationship with field-dependence/independence was total time employed in the organization. Thus, those persons employed for fewer years were more field-independent than those employed for a longer period. Age, sex, level of education and academic and applied experience were eliminated as confounding variables, which then meant that the difference could only be due to the period of time employed, indicating that the individuals became more field-dependent as time passed and also providing evidence that this style is not completely unchangeable.

The mobility/fixity dimension. Werner (1957, in Hansson *et al.*, 1986; Niaz, 1989) introduced the mobility/fixity dimension, and conceptualized perceptual development as a progression from global (or field-dependent) to analytical (or field-independent) and finally, in the fully developed mature individual, to synthetic or field-mobile. Field-mobility indicates that functioning shifts from the field-dependent to the field-independent mode, or vice versa. This shift is determined by situational requirements and indicates the use of a variety of mental operations to attain higher adaptability. If the mature individual displays fixed functioning, that is, continuously functions in one mode only without displaying characteristics of both styles, it indicates arrested development or the use of a limited set of mental operations. Thus, such an individual uses either an analytic-active or global-passive orientation exclusively. According to Witkin (1965, in Niaz, 1989), being able to shift from one mode to the other facilitates creativity.

Mobility on the field-dependence continuum is defined by Hansson *et al.* (1986, p. 291) as "an inclination to try new and unconventional solutions," while mobility on the field-independence continuum is seen as "a flexible orientation towards subjective and objective factors based on both an ability to differentiate self from non-self aspects of perception and a readiness to integrate those aspects." Fixed field-independency implies inadequate integration and inflexibility of perception or a rigid differentiation of parts of the perceptual field. Evidence in support of this relationship is based on observational and experimental data.

Measurement instruments. The two most widely used tests for the assessment of this style are the Rod and Frame Test (RFT) and the Group Embedded Figures Test (GEFT). The RFT assesses the accuracy (and/or speed) of setting a rod to the vertical, despite the tilt of one's chair and of a frame around the rod. The GEFT, a measure of cognitive restructuring, assesses the accuracy and/or speed of locating embedded figures.

Both these tests have been severely criticised. McKenna (1984) considers the GEFT as an ability measure and not a style measure because differences between subjects are of a quantitative and not a process nature. McKenna feels that the GEFT measures general abilities, specifically general intelligence, spatial visualization and fluid ability. Research conducted using the GEFT need to be reinterpreted in light of these shortcomings. Another criticism levelled against the GEFT is the interchangeability with which the RFT and GEFT are used as a measure of field-dependence despite the fact that the average correlation between these two has been found to be .44 with a shared variance of less than 20% (Fine & Danforth, 1975). As far as the mobility-fixity dimension is concerned, the GEFT only assesses the analytic end of this continuum and does not distinguish between mobile and fixed field-independent subjects (Niaz, 1989).

Characteristics associated with field-dependence and field-independence. Several differences between field-dependent and field-independent individuals in their approach to a variety of cognitive task have been established. This style has also been linked to personality and interpersonal variables.

The literature suggests that there are certain differences in learning patterns for field-dependent and field-independent individuals. The former approach learning situations by viewing the content globally, impose their own structure on the task, experience difficulty distinguishing parts of the task separately from the whole, view learning material passively and follow an intuitive, spectator approach. In contrast, the latter are good at disembedding parts from the existing organization of material, devising an alternative organization to facilitate comprehension, are active learners (which become evident in hypothesis testing and employment of verbal mediators) and follow a participator approach. The importance of this difference lies in the fact that, for learning to be optimal, the learner should be able to distinguish the important information from the background or irrelevant information, so that the latter is excluded from the learning (Brooks, Simutis & O'Neil, 1985; Doyle & Rutherford, 1984; Goodenough, 1976; Kotzé, 1985).

According to Goodenough's (1976) review support was found for style differences in concept attainment tasks. Field-dependent subjects differ from field-independent subjects in that the former are led by salient cues while the latter sample more fully from the available cue set, indicating strategic differences in that field-dependent subjects follow a partist (versus holist) strategy more often than field-independent subjects. Goodenough concluded that the differences between these learners does not necessarily mean that field-independent individuals are better learners. The two styles are simply different. Field-independent learners learn and remember more under certain conditions, but field-dependent learners are superior under other conditions, depending on the material involved. Although there are significant differences in the approach taken by field-dependent and field-independent individuals in learning situations, the outcome or effectiveness does not significantly differ.

It has been demonstrated that field-independent individuals perform better under conditions of intrinsic motivation, while field-dependent individuals perform better under conditions of negative reinforcement (Goodenough, 1976). Because of the relationship between field-independence and intrinsic motivation and the finding that these individuals have more definite internalized values and standards regulating their behaviour, as well as being more perseverant and systematic in learning situations, Heppner and Krauskopf (1987) hypothesize that field-independent individuals may have difficulty in looking at situations in new ways when a situation matches previously learned patterns and may need help in establishing interrelationships among problem elements. They are systematic learners which may pose problems as far as the identification of relationships and a shift to new patterns are concerned. On the other hand, the authors hypothesize that since field-dependence is related to high competence in perceiving relational networks, incidental learning of social stimuli and good adjustment to new requirements, these individuals may have difficulty with matching as they see too many things as related and may need help to distinguish problems from one another. Their more relative value structure may lead to problems judging which elements of a pattern are more important. These relationships still need to be established empirically.

In terms of personality factors, field-dependent individuals are seen as social, outgoing, friendly and people-oriented, especially interested in and dependent upon social interactions and the social environment, socially sensitive, possessing well developed social skills, relatively unaware of inner feelings and reliant on external referents for the definition of their feelings, attitudes and thoughts and utilizing defenses such as repression and denial. In contrast, field-independent individuals are seen as introspective, preferring solitary situations, socially independent, socially insensitive, with less concern for others and less interest in interpersonal situations, less open to persuasion, dependent on a well developed internal frame of reference for guidance of their behaviour, (i.e. awareness and reliance on own feelings, needs, thoughts and attitudes) and possessing intellectualized defensive operations (Doyle & Rutherford, 1984; Okonji, 1980; Tobacyk, Broughton, & Vaught, 1975).

From this the assumption can be made that field-independent individuals would be introverts and field-dependent individuals extraverts. But this relationship has, in fact, not been established. Some studies found a significant relationship between field-dependence/independence and extraversion/introversion, while other studies have failed to demonstrate such a relationship (see Morris, 1979; Schmidt & McCutcheon, 1988). According to the study of Fine (1972, in Morris, 1979) individuals fall into four categories, that is field-dependent and extraverted, field-independent and introverted, field-dependent and introverted, and field-independent and extraverted, with congruence being the important factor. It was found that the psychologically unhealthy combination was field-dependence and introversion, a combination which is significantly related to neuroticism and anxiety. This demonstrates that the relationship of cognitive style to personality variables is more often than not complex.

The same applies to the association between field-dependence/independence and locus of control. A general assumption is that field-independent individuals rely upon an inner locus of control, seeing themselves as controlling their own lives, while field-dependent individuals are characterized by an external locus of control, viewing external forces as controlling their lives. However, research demonstrated a more complex relationship, with individuals falling into one of four groups, with the important factor being congruence. Congruent subjects (field-independent with internal locus of control and field-dependent with external locus of control) have shown better adjustment on personality scales and performed better on cognitive tasks than the incongruent subjects (field-independent with external locus of control and field-dependent with internal locus of control) (Tobacyk *et al.*, 1975).

Career choice has been shown to be related to this dimension. Witkin's (1976, in Kolb 1984) findings are congruent with personality variables associated with the two styles. Field-dependent students choose to specialize in fields that favour involvement with people, such as teaching, marketing, management and the humanities, whereas field-independent students choose to specialize in fields that favour analysis, such as physical sciences, engineering, technical and mechanical fields. Witkin also found that field-dependent individuals make career choices adopted by their peer group, while field-independent individuals make these choices through use of systematic planning and goal setting.

Research has also been carried out concerning the mobility-fixity dimension. In the study by Niaz (1987, in Niaz 1989) on academic problem solving it was found that mobile field-dependent and field-independent subjects performed better on problem solving in freshman science courses than fixed subjects. This is attributed to the mobile subjects' flexibility and adaptability of functioning on these type of courses. As far as formal analytical tasks are concerned fixed field-independent subjects performed better than mobile subjects.

In a study on creativity, using measures of creative thinking, formal reasoning and intelligence, Niaz (1989) found that mobile individuals performed significantly better than fixed individuals on all creativity (divergent thinking) measures, including fluency, flexibility, originality, elaboration and total creativity. They expected mobile field-independent subjects to perform better than fixed field-independent subjects but the results revealed a nonsignificant difference, with the only exception the results of the formal reasoning measure. Again fixed field-independent subjects performed better on formal analytical tasks than mobile field-independent subjects and since differences in performance cannot be attributed to intelligence, it is seen as the result of style differences. It is suggested that the development of creativity can be enhanced through mediation of the mobility-fixity dimension.

Hansson *et al.* (1986) demonstrated that field-independent individuals are more mobile than field-dependent individuals, which contradicts Witkin's assumption that mobility would be more pronounced in individuals having an intermediate position on the field dependence/independence continuum.

Most problems with the above studies involve the failure to demonstrate the exact process differences (the metacognitive or problem solving processes used). These problems can be attributed to problematic measurement instruments, since conventional tests cannot reveal the processes involved in style differences.

Conclusion. The reasons for the inclusion of field-dependence/independence with pure cognitive styles concern the theoretic definition thereof, indicating bipolarity of the dimension, the specification of process-differences in information processing (for example, global versus analytic processing), the absence of value-judgements (even though contradictions are found in the literature) and research indicating the broad range of application thereof (for example, cognitive tasks, personality factors and preferences for interpersonal relations have been associated with this style). Nevertheless, although theoretically the constructs are defined to indicate style differences, the measurement instruments reveal many shortcomings and if the focus had been restricted to these measures this style could easily be included with Class 1 styles. For example, the description of these measures, that is, the ability to overcome embeddedness, is a very narrow ability description. However, it is recommended that the instruments be adapted, or even replaced with ones satisfying the criteria for style measures, which will also assist with reinterpreting data thus far obtained using the GEFT and RFT.

3.3.2 The Verbalizer-Visualizer Dimension

The verbalizer-visualizer dimension is a bipolar dimension, with a preference for verbal processing at the one end and a preference for visual processing at the other end. Verbalizers think in terms of verbal representations and tend to process information sequentially while visualizers think in terms of mental images and make use of parallel processing of information.

The Verbalizer-Visualizer Questionnaire devised by Richardson (Green & Schroeder, 1990; Stevens, Rapp, Pfost & Johnson, 1986) is used to assess functioning on this dimension and measures the extent to which a person's preferred mode of information processing consists of self-statements or mental images. According to Richardson (1977 in Tower & Singer, 1981) there is much evidence that this continuum reflects stable individual differences in processing style.

These styles are value-differentiated, each having their own unique strengths and weaknesses. Verbalizers are well skilled in sequential analysis of components and follow a logical approach to events, but may experience problems with global processing of events. Verbalizers, with their preference for the use of language which is a social phenomenon, may experience difficulty in dealing with concrete events and emotions since they continuously make abstractions from these and transform their experiences into symbols which have socially shared meaning. This means that verbalizers need to be taught to deal with unstructured situations, unexpected events and negative effects (Tower & Singer, 1981). Visualizers, on the other hand, fare well with global processing but may experience problems with the breaking down of events in order to analyze these sequentially. Tower and Singer (1981) suggest that these individuals must be taught to communicate less autistically and to control behaviour through verbal mediation.

As can be seen from the above description of the characteristics of this processing style it is made applicable to both cognitive and social situations and this demonstrates the broad range of its applicability.

Much empirical evidence for the existence of these style differences can be found in the literature (see Green & Schroeder, 1990; Tower & Singer, 1981), including the studies by MacLeod *et al.* (1978, in Cohen, 1983) and Hunt (1978, in Cohen, 1983). Using sentence verification tasks, these researchers found that verbalizers had a high verbal ability and preferred using a verbal strategy, while visualizers had a high spatial ability and preferred a nonverbal strategy. In another study conducted by Van der Veer (1989), using a computer learning task, it was found that verbalizers and visualizers require different approaches for successfully completing such a learning task.

3.3.3 Levelling versus Sharpening

Levelling versus sharpening refers to "individual differences in the assimilation tendency of the memory" (Tiedemann, 1989, p. 266). Sharpeners attend to fine nuances and small differences by magnifying small differences among memories while levellers show high assimilation effects by blurring small differences among memories, causing differences to be lost or attenuated (Wardell & Royce, 1978). In learning situations levellers attempt to unify new learning, thus remembering the whole situation rather than small parts thereof, while sharpeners focus on small parts and details and remember these rather than the global situation (Doyle & Rutherford, 1984).

Numerous problems, including doubts regarding construct validity, are cited by Tiedemann (1989) regarding the measurement instrument - the Schematizing Test. Research findings are not discussed here because of these problems, as well as the absence of findings regarding process differences in this style of information processing.

Although there is no reliable and valid instrument measuring this construct, as far as the theoretical definition is concerned, it is judged to be a pure cognitive style, with levelling and sharpening being located on a bipolar scale, both having advantages and disadvantages.

3.3.4 Holistic versus Serialistic Cognitive Style

The styles identified as "Whole-Part Approach" (Goldner, 1957), "analytic versus holistic processing" (Smith & Kemler Nelson, 1988), and holism-serialism (Van der Veer, 1989) all refer to the same construct, here called holistic versus serialistic processing.

Goldner's (1957) "Whole/Part Approach" represents a continuum ranging from a predominant whole approach at the one extreme, with a whole-part approach at an intermediate level, and a predominant part approach at the other extreme. The type of perception an individual has of a problem (holist or serialist), his ability to break problems down into parts and his ability to organize parts into wholes are taken into account during assessment. Whole responses include the whole area of the problem, or a great number of parts, the absence of manipulation of problem material, with a focus on the formulation of a plan or solution, and quick solutions with an absence of analysis (or further evaluation). Part responses include extensive manipulation of problem material, random responses referring to a single aspect of the problem, analysis of the problem into separate parts with attempts to solve each part separately and formulation of plans which usually pertains to part of the problem.

This corresponds to Smith and Kemler Nelson's (1988) definition of the style, with analytic processing referring to the treatment of stimuli in terms of their values on independent dimensions that may be selectively attended to and holistic processing referring to treatment of the stimulus as an integral whole.

Characteristics associated with holistic and serialistic processing. Goldner (1957) investigated holism/serialism, using two types of testing situations, structured and unstructured, and found that individuals show consistency regardless of the content of or the degree of structure imposed on the testing situation. Furthermore, the importance of this study comes to light when considering the fact that intelligence was held constant by using only subjects whose scores were very similar, so that differences in performance cannot be attributed to differences in abilities. Goldner (1957) has also demonstrated that the holist/serialist style is related to flexibility/rigidity especially when using structured tests as measurement instruments, although the two styles appear unrelated when using unstructured tests.

As far as teaching students is concerned, the study by Van der Veer (1989), using computer-assisted instruction to teach syllogistic reasoning is notable. Students who were identified as either holistic or serialistic learners and who were instructed using their preferred style as teaching style, did not differ in terms of the time needed to solve the problems. No difference regarding the effectiveness of the two teaching styles was found. The important finding was that an incongruence between problem solving style and training style resulted in poorer performance, demonstrating the importance of congruence between cognitive style and training style and the advantages of presenting holists with exercises of the total skill early in the exercise, while presenting serialists with a step by step approach. It is important to further investigate this relationship, especially with respect to other types of teaching situations.

The process differences involved in using a holistic versus serialistic processing style have been adequately demonstrated, although a demonstration of the relationship of this cognitive style to variables in other domains, such as personality and interpersonal behaviour, is still to be established.

3.4 COGNITIVE STYLE REMEDIATION

Remediation can only be applied in those circumstances where one style is considered inferior to another. The styles which fall in this category are called Class 1 Styles (see section 3.2). It has been shown that these styles are related to performance on a variety of tasks as well as learning in a variety of settings, especially in the classroom. It is therefore imperative that those individuals identified as employing an inferior style should receive remediation to correct the situation. In this discussion we will focus on reflection/impulsivity and the modification of an impulsive cognitive style using a variety of strategies.

3.4.1 Teaching Task Strategies

It has been shown repeatedly that impulsives do not only scan and analyze problem material less extensively than reflectives, but also do so less systematically. Several investigators instructed impulsive children in the use of more effective task strategies, i.e. scanning material more extensively and systematically. Egeland (1974) attempted to teach impulsives the rules and strategies employed by reflective individuals. That included (1) studying the standard stimulus and all the alternatives in a matching task, (2) breaking down the alternatives into component parts, and (3) checking the standard to determine its correct form. It was found that MFFT latencies were increased while error scores were decreased by using this method. In another exercise of this kind it was found that teaching proper task strategies were more successful than forced delay of responses or the increase of motivation (Heider, 1971, in Messer, 1976). Egeland (1974) later established that teaching task strategies were not more successful than forced delay of responses but that the former's results were maintained longer.

The problems identified with teaching task strategies were (1) poor generalizing of effects to performance on tests other than the MFFT, except in the case of Egeland's (1974) findings, where subjects showed improvement on a vocabulary and comprehension test, (2) the short-term effects of the training (except in cases where training had been elaborate and the follow-up period brief), so that more than one training session might be necessary to achieve durable and generalizable effects, and (3) the lack of a reflective style becoming deeply entrenched and automatic in the subject, since effective information processing requires a reflective approach without concentrating on the mechanics of such a strategy (Egeland, 1974).

3.4.2 The Use of Modelling and Self-Instruction

Meichenbaum and Goodman (1971) also employed the strategy of teaching more efficient scanning strategies, but added verbalization and modelling to ensure that scanning instructions were attended to and incorporated. They found that response times increased whether or not verbal self-instruction occurred and also that self-instruction had an effect on error scores not present in the other group. These researchers also found that modelling on its own was sufficient to alter response time, but not efficient in decreasing error rates. The use of modelling together with self-instructions significantly altered both latency and error scores, altering the attentional strategies of impulsives and facilitating self-control.

In a study of cognitive-behavioural treatment, Kendall and Finch (1978) made use of modelling and verbalized self-instructions in a training programme which included conceptual thinking, attention to detail, recognition of identities, sequential recognition, visual closure and visual-motor reproduction, and found that their programme was effective in modifying impulsivity in emotionally disturbed children, altering both latency and error scores. It is, however, not possible to determine which teaching strategy has contributed most to the treatment effect.

3.4.3 The Use of Reinforcement

Purdue (1973, in Messer 1976) combined the use of self-instruction with self-reinforcement and external reinforcement. The group receiving self-reinforcement showed greater increases in response time and decreases in error scores on the MFFT than the group receiving external reinforcement, with the same result obtained on post-tests.

Research indicates that anxiety over failure is a factor in reflectivity. Therefore, teaching impulsive individuals to be concerned over failure, or to be more motivated to succeed, could lead to more reflective behaviour. Massari and Schack (1972) investigated this relationship and found that in situations which increased anxiety over response accuracy also increased reflectivity in lower-class children. Unfortunately these results cannot be generalized to other populations. They found that negative feedback was more effective than positive feedback to decrease error scores, in both impulsive and reflective subjects.

3.4.4 Baron's Normative Model for Cognitive Style Modification

According to this model training individuals to use more effective problem solving styles, involves normative questions, for example what is optimal for each subject in each task. The effectiveness of teaching an individual, who stops thinking too soon, to become more reflective, depends not only on the technique used but also on the individual and task involved. Teaching a reflective attitude would, therefore, only be effective if it leads to a decrease in error rates. Thinking should only continue as long as it remains effective. After that reflection would make no difference in performance and may become suboptimal when the individual does not possess the ability to solve the problem.

This illustrates that it is important to identify and train only those individuals who will benefit from further thought. The individual who will not benefit from training should not be called impulsive. This position, therefore, regards the study of individual differences in cognitive style as "concerned with differences in the degree of deviation from the optimum point rather than differences in position on the continuum" (Baron *et al.*, 1986, p. 182). Thus, an individual is only identified as impulsive if he or she underestimates the value of further thinking relative to its cost.

In this training study, in which the training methods were based on traditional and cognitive-behaviour modification, the use of self-instructions and training students to view failure as internally based (lack of effort) instead of due to stupidity or external factors, it was attempted to modify impulsivity, rigidity and nonpersistence. It was demonstrated that, apart from the effectiveness of the above methods, teachers were effective predictors of which students, identified as impulsive, would benefit from training. This leads to the conclusion that teachers are sensitive to deviations from optimal performance defined in normative terms.

From the studies discussed in this section it can be seen that the combination of cognitive training procedures and behavioural contingencies offer the most promise in altering impulsive behaviour.

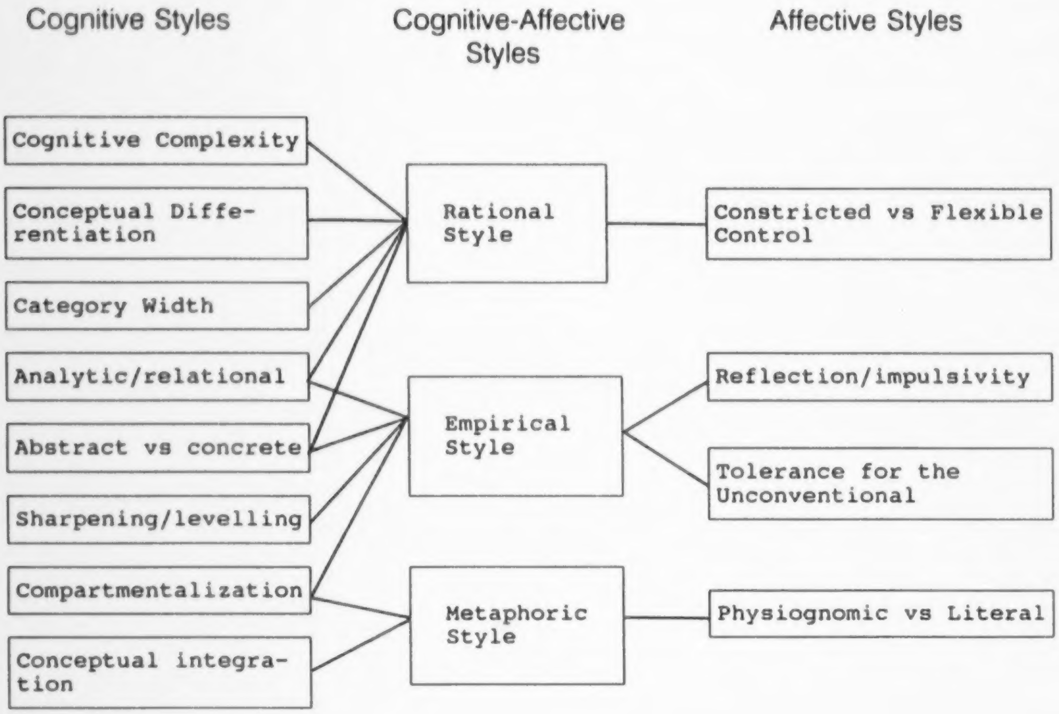
3.6 AN INTEGRATIVE THEORY OF PERSONALITY AND COGNITIVE STYLES

Royce and his colleagues (see Diamond & Royce, 1980; Diamond, Royce & Voorhees, 1981; Royce & Diamond, 1980; Royce & Powell, 1983; Wardell & Royce, 1978) have attempted to integrate styles theorizing into one integrative theory and have proposed a multidimensional, system-dynamic model of stylistic processing in which they conceive of styles as cognitive, affective, and cognitive-affective constructs. Style is one of six subsystems of the total personality organization. The other five are sensory, motor, cognitive, affective and value systems and are central aspects of personality organization. Styles are viewed as integrators or moderators of personality, linking cognitive and affective traits. The cognitive system is organized on successive hierarchical levels, from molecular to molar. Both structural and process features of cognition are accommodated and interrelated in this theory. This framework is advantageous as a guide for future research.

The proposed hierarchy of styles consists of three general styles or higher-order constructs, namely rational, empirical and metaphoric, with each reflecting three different ways of integration of cognition and affect. ***Rationalism*** is described as a view of reality determined by a commitment to rationality. The validity of this view of reality is tested by its logical consistency, using as major underlying cognitive processes clear and abstract thinking, rational analysis and synthesis of ideas and an emphasis on conceptualizing as mode of processing. ***Empiricism*** is a view of reality determined by a commitment to external experience. The validity of this view is tested in terms of the reliability and validity of observations, with the major underlying cognitive processes involving active perception and seeking of sensory experience and an emphasis on perceiving as mode of processing. ***Metaphorism*** as a view of reality is determined by a commitment to metaphoric experience. The validity of this view is tested in terms of the universality of the insight of awareness. The major underlying cognitive processes used are of a symbolizing nature and deal with connotative meaning imaginatively.

The relationship of cognitive styles to the three-higher order styles, as well as the relationship of these to cognitive-affective styles is depicted in the Figure 3.2, taken from Wardell and Royce (1978, p. 487). The linkages between the cognitive styles and their cognitive-affective styles are clear. As can be seen from Figure 3.2, four affective styles are postulated, of which two are motivational and two emotional controls. Reflection/impulsivity and "physiognomic versus literal" are defined as emotional affective styles. Physiognomic individuals infuse percepts with emotional or expressive qualities, ascribing movement to inanimate objects or events, which indicates their preference for the dynamic and emotive rather than the static and literal. The two motivational affective styles are: (1) tolerance for the unconventional, defined as an acceptance of experiences which do not agree with what one knows to be true. This is important as far as determination of levels of aspiration and patience during goal-oriented activities involving unusual or unconventional matters are concerned; and (2) constricted versus flexible control, defined as differing reactions to stimulus fields which contain contradictory or intrusive cues (Wardell & Royce, 1978).

FIGURE 3.2 : RELATIONSHIP OF COGNITIVE-AFFECTIVE STYLES WITH COGNITIVE AND AFFECTIVE STYLES


Cognitive Styles
Cognitive-Affective Styles
Affective Styles
Cognitive Complexity
Conceptual Differentiation
Category Width
Analytic/relational
Abstract vs concrete
Sharpening/levelling
Compartmentalization
Conceptual integration
Rational Style
Empirical Style
Metaphoric Style
Constricted vs Flexible Control
Reflection/impulsivity
Tolerance for the Unconventional
Physiognomic vs Literal

Wardell and Royce (1978) also postulate specific relationships between cognitive-affective styles and cognitive and affective constructs (such as field-dependence/independence), cognitive abilities (such as conceptual, perceptual and symbolizing abilities) and affective traits (such as emotional independence, extroversion, inhibition, etc.). A detailed discussion of the hypothesized relationships are offered in Diamond and Royce (1980), Diamond *et al.* (1981), Royce and Diamond (1980), Royce and Powell (1983), and Wardell and Royce (1978). Since these relationships have not been shown to exist empirically, they will not be discussed here.

3.6 COGNITIVE STYLE THEORIES VALIDATED BY THE USE OF SELF-REPORT INVENTORIES

3.6.1 Kirton's Adaption-Innovation Theory

The adaption-innovation dimension is a bipolar personality dimension, with the habitual innovator and habitual adaptor at the extreme ends of the continuum (Kirton, 1976; Kirton & De Ciantis, 1986). Mulligan and Martin (1980), however, view the adaption/innovation typology as multidimensional, representing a compound function of ideational, stylistic and attitudinal variables. According to Kirton's theory individuals characteristically have different styles of thinking, problem-solving, creativity and decision-making. The main distinction between adaptors and innovators involves their task orientation: adaptors solve problems using existing frames of reference and innovators change the frameworks of problems to solve them. Both orientations have their own characteristic strengths and weaknesses.

This dimension has a broad range of applicability, and can be used advantageously in the assessment of problem solving, decision-making and management. It can also be used for team building in organizational contexts (see Clapp & De Ciantis, 1989; Kirton, 1980; Kirton & McCarthy, 1985; Stein, 1990) as it involves personality, cognitive, as well as interpersonal domains.

Measurement instrument. The Kirton Adaption-Innovation (KAI) Inventory is a self-report instrument consisting of three subscales, each representing a component or behavioural pattern. These are (1) ***Originality*** or the tendency to deviate from convention by forming new ideas; (2) ***Efficiency*** or the tendency to work methodically, conscientiously and in structured ways within a structured environment; and (3) ***Rule/Group Conformity*** or the expression of an aversion for risk taking and a need for rules.

The existence of the above three factors have been demonstrated with internal reliabilities estimated at .80. Evidence has also been found for the internal consistency of the KAI, the stability thereof across diverse populations and different cultures (see the studies of Beene & Zelhart, 1988; Joniak & Isaksen, 1988; Mulligan & Martin, 1980; Taylor, 1989), the absence of a social desirability response set (Goldsmith & Matherly, 1986), and measurement of cognitive styles rather than cognitive level (Kirton & De Ciantis, 1986).

Characteristics of adaptors and innovators. The behavioural characteristics of adaptors and innovators are summarized in Table 3.2. In support of the characteristics of adaptors and innovators, it was found that innovators are low in dogmatism and high in sensation seeking and risk taking, a relationship which was expected since innovators seek new and different things and solutions (Goldsmith, 1984).

Using the Sixteen Personality Factor Questionnaire (16PF) and the KAI (Originality dimension), Kirton and De Ciantis (1986) found that adaptors are more submissive and innovators more assertive, and since the latter's ideas are more novel, they need to be more assertive so that these ideas are accepted. It was also found that the Rule/Group Conformity subscale is related to the Conservative/Experimenting factor of the 16PF, with adaptors being more conservative and innovators more experimenting. Furthermore, adaptors are high on the factor Conscientiousness and Control and innovators high on Expedience and low on Control, which is in line with the adaptor's attention to detail and efficiency, and the innovator's focus on the whole rather than detail. All other correlations with 16PF scales were small or insignificant, leading these researchers to conclude that only a part of the entire personality is important in determining cognitive style preferences.

The KAI, which was found to be unrelated to level of intelligence (Goldsmith, 1986; Kirton & De Ciantis, 1986), is a valuable instrument to use within organizations and it has been demonstrated that it can be used to find appropriate fits between managers and organizations, as well as in organizational development (Holland, 1987), individual development, understanding and tolerance of self and others, team development and functioning, management development (Kirton & McCarthy, 1985) and decision-making (Clapp & De Ciantis, 1989; Stein, 1990). It was found that adaptors are favoured in government organizations (Hayward & Everett, 1983 in Holland, 1987) and banking (Holland, 1987).

The most serious shortcoming of this type of instrument in the establishment of individual differences in cognitive styles, is the fact that cognitive process differences cannot be assessed. It should also be kept in mind that pure types will rarely, if ever, be found, but that individuals display both characteristics of adaptors and innovators in unique combinations.

TABLE 3.2 BEHAVIOURAL CHARACTERISTICS OF ADAPTORS AND INNOVATORS (adapted from Kirton, 1976, p. 623).

ADAPTORS	INNOVATORS
Precise, reliable, efficient, methodical, prudent, disciplined, conforming.	Thinking tangentially, seen as undisciplined, approach tasks from novel angles.
Concerned with resolving rather than finding problems.	Discover problems and solutions.
Seek solutions in tried and understood ways.	Query problems' concomitant assumptions; manipulate problems.
Reduce problems by improvement and greater efficiency, with maximum of continuity and stability.	Catalyst to settled groups, irreverent of their consensus; seen as abrasive, creating dissonance.
Seen as sound, conforming, safe, dependable.	Seen as unsound, impractical; often shock opposition.
Liable to make goals of means.	In pursuit of goals; treat accepted means with little regard.
Seem impervious to boredom, seem able to maintain high accuracy in detailed work.	Only capable of detailed routine for short periods; quick to delegate routine tasks.
An authority within given structures.	Tend to take control in unstructured situations.
Challenge rules rarely, only when assured of strong support.	Often challenge rules; little respect for past custom.
High self-doubt. React to criticism by closer outward conformity. Vulnerable to social pressure and authority.	Low self-doubt when generating ideas, not needing consensus to maintain certitude.
Essential to functioning of institution; occasionally need to be "dug out" of his/her systems.	Ideal in unscheduled crises, or helping to avoid these, if he/she can be controlled.
When collaborating with innovators: supply stability, order, continuity to partnership.	*When collaborating with adaptors:* supply task orientations, break with past and accepted theory.
Sensitive to people, maintain group cohesion and cooperation.	Insensitive to people, often threaten group cohesion and cooperation.
Provide safe base for innovator's riskier operations.	Provide dynamics to bring about periodic radical change, without which institutions tend to ossify.

3.6.2 Churchman's Thinking Styles

Churchman (1971, in Kagan, 1988; Thier, 1989) proposed five basic styles of thinking, namely the synthesist, idealist, pragmatist, analyst and realist, having the following characteristics:

(1) The *synthesist* sees the likeness in apparent unlikes, seeks conflict and synthesis, is interested in change, is speculative, views data as meaningless without interpretation, and focuses on assumptions and on abstract concepts.

(2) The *idealist* welcomes a broad range of views, seeks ideal solutions, is receptive, values data and theory equally, and focuses on process, values, and aspirations.

(3) The *pragmatist* focuses on "whatever works", seeks the shortest route to success and immediate payoffs, is interested in innovation, is adaptive, uses any data or theory equally and tends to use incremental thinking.

(4) The *analyst* seeks one best way, model and formula, is prescriptive, is interested in scientific solutions and values data over theory and method, seeks predictability through ordering data, and attends to the concrete.

(5) The *realist* relies on facts and expert opinions, seeks solutions that meet current needs, focuses on available resources, is interested in concrete results, is corrective, and takes data over theory (Kagan, 1988; Thier, 1989).

Measurement instrument. Harrison and Bramson (1985, in Kagan, 1988) developed the Inquiry Mode Questionnaire (InQ), designed to assess these five basic styles. This questionnaire consists of 18 hypothetical situations, with five possible responses representing each of the five thinking styles. Bruvold, Parlette, Bramson and Bramson (1983) performed a factor analysis and found support for the five theoretical styles. Also, the InQ is judged to be reliable.

The value of an instrument such as the InQ is that the most typical behaviour expressed by an individual in decisional processes is reported. This instrument was developed with the express purpose to focus on decisional styles in management. As such, it is valuable, but not applicable in the assessment and training of problem solving styles in educational and organizational settings, other than on management level, and is therefore not regarded as a measure of cognitive style in the strictest sense.

3.7 SUMMARY AND CONCLUSION

Many problems with cognitive styles arise out of the theoretical and empirical bases of styles, because of methodological weaknesses, fragmented research, and the weak generalizability of research findings. This negatively affects the integrity of current interpretations of certain cognitive style dimensions. As far as theoretical weaknesses are concerned, most cognitive style dimensions do not satisfy the criteria of bipolarity, value-differentiatedness and range of application, that is, styles have generally been explained in terms of cognition without taking into account personality and affect.

These cognitive "styles", discussed as Class 1 styles, have both a focus on skill and manner of performance. It has become clear from the discussion that research into these dimensions and the development of training instruments are important because individuals can be assisted to become more effective problem solvers. Nevertheless, even though such a perspective may be advantageous as far as thinking skill training is concerned, the problem we confront is one of semantics: referring to these dimensions as cognitive styles is considered using the incorrect term, since theoretically and operationally, these dimensions do not satisfy the criteria for classification as cognitive styles. Being reluctant to attach the term "ability" to these dimensions, because of the exclusive focus of ability measures on the product of performance, it is recommended that these rather be thought of as cognitive skills.

Class 2 or pure cognitive styles include those dimensions that satisfy the criteria, but unfortunately, situation dependency and intra-individual shifts within these styles have not received much attention. It is important in this regard to take into account variables such as the individual's assessment of the task, his expectation of success, and the seriousness with which the task is approached.

That the gap between the theoretical conceptualization of cognitive styles and the empirical validation thereof is at times enormous, becomes obvious from the discussion in section 3.3. In most cases it is not the theory which should be adapted, but the measurement instruments, which in many cases have been based on psychometric principles and are incompatible with style theorizing.

Tiedemann (1989) views the cognitive style concept as a complete failure on a diagnostic and empirical level and advises that, although cognitive styles exist, the research into it should be abandoned. The abandonment of cognitive styles, is however, not the answer; rather, we need to reconceptualize our view of assessment instruments, moving away from conventional type of tests to tests that enable us to formulate process measures capable of establishing relationships between cognition, personality, interpersonal behaviour and other important variables that affect functioning in a variety of situations.

The use of self-report instruments have certain advantages over the use of conventional measures in establishing the relationship of cognitive style to other variables, as has been demonstrated by research employing the KAI for purposes such as individual and organizational development. The most serious shortcoming of these instruments is the lack of measurement and establishment of cognitive process differences in problem solving. It is recommended that a middle ground be found between the two approaches, so that the best of both can be utilized for assessment purposes and the development of individuals in various settings.

4.0 LEARNING STYLES

Learning styles differ from cognitive styles in fundamental ways and should not be confused with the broader concept of cognitive style. Learning styles refer to the practical application of one aspect of cognitive styles. While cognitive styles include learning, learning styles do not include all the aspects of cognitive styles. Kirby (1979, in Rademeyer, 1990) is of the opinion that cognitive styles are more firmly established as part of the personality than learning styles, with the latter being manifestations of the former.

The main differences between learning styles and cognitive styles are found in the application thereof: cognitive styles can be made applicable to a wide variety of situations, while learning styles are only applicable to classroom behaviour and the learning situation. Furthermore, cognitive styles imply bipolarity whereas learning styles imply multidimensionality with the dimensions operating interactively. In measuring cognitive styles, many different types of tests and laboratory tasks are employed, while self-report measures are predominantly used to determine learning styles.

4.1 CHARACTERISTICS AND USE OF LEARNING STYLES

Learning styles are mainly applicable to learning situations and are related to cognitive styles in the sense that the preferred or habitual patterns of mental functioning, including information processing and formation of ideas and judgments, are of interest. Therefore, in order for a learning style theory and a measurement instrument to be useful to teachers and instructors, the postulated styles should be easy to assess and understand. The type of instrument most often used in the assessment of learning styles is the self-report inventory. Many learning style theories exist, and just as many inventories have been created.

Learning styles are also related to attitudes and interests, in that these variables influence what will be attended to in a learning situation. Individuals are expected to seek out learning situations or environments that are compatible with their learning styles and to avoid environments which are at odds with their attitudes and interests. Furthermore, learning styles also influence the type of tools individuals prefer to use when engaged in a learning situation.

In the assessment of learning styles one needs to start with the whole and not the isolated parts by taking into account both cognitive strategies and styles, learning styles and the material to be learned (Davis and Schwimmer, 1981).

Attaching a value judgement to learning styles would be erroneous, since no single style is better than any other. A particular style should rather be viewed in terms of its usefulness in a particular situation. The use of learning styles to create stereotypes and to categorize individuals to such an extent that they cannot get rid of labels should be avoided. Such typing is dangerous, especially in view of the fact that a typology of learning styles represents pure types only in a theoretical sense, while in practice pure types are extremely rare. Furthermore, it is possible for individuals to develop different learning styles or enhance their own learning styles and, therefore, the use of learning style instruments should be aimed at developing the potential of individuals and not for rigid categorization.

Since learners differ in a variety of ways, these differences influence their response to and the benefits they derive from instructional methods. It is often recommended that instruction should be adapted to fit the individual's intellectual or emotional aptitudes, a recommendation based on the hypothesis that this will lead to higher levels of achievement (Doyle & Rutherford, 1984).

When considering the effects a teacher or instructor has on his or her students, with teachers and students at times demonstrating very different preferences as far as learning situations are concerned, the assessment of learning styles becomes even more important. Both personality types and learning styles are related to choice of career as demonstrated by Briggs-Myers and McCaulley (1985), Kolb (1984) and many other researchers. Therefore an assumption, such as that of Keirsey and Bates (1984), that individuals with certain cognitive styles are overrepresented as teachers and instructors in our schools, universities and other training environments, does not seem farfetched, although this needs to be proven empirically. The effects of teachers imposing their own styles on their students would then be farreaching. Kuchinkas's (1979) observations in classrooms led her to conclude that the teacher's style is an important factor as far as learning is concerned, as it determines how students learn. Teachers impose their cognitive styles on students by determining which type of behaviour is to be engaged in in the classroom and by employing the modes of instruction with which they feel the most comfortable. The students are expected to adapt to the teacher's cognitive style. Since it has been shown that those children whose cognitive styles and learning styles correspond with the teacher's benefit the most from the instruction, it is important to consider the influence of the teacher's style on the student whose learning style differs dramatically from that of the teacher. Educators, at all levels of education, should be made aware of the influence their cognitive and learning styles have on their students.

This does not mean that the educator should adjust his or her style to fit each student, which would be an impossible task, but awareness of style can create opportunities to identify situations where it is necessary to shift from one style to another to overcome specific problems in the educational process. Exposing a student only to his or her preferred style is not always be advantageous. According to Schmeck (1981, in Dunn, DeBello, Brennan, Krimsky & Murrian, 1981), the development of higher level or metacognitive strategies depends on exposure to contextual demands that do not perfectly fit the student's preferred style, which will facilitate the development of flexibility.

4.1.1 Definition of Learning Style

Many models of learning style theories exist, and the definitions of learning and learning styles are just as varied. For example, Kolb (1984) advanced a process definition of learning, seeing it as the creation of knowledge through the transformation of experience. Learning style is seen as the result of hereditary endowment, experience and situational demands.

Claxton and Ralston (1978, in Hayden & Brown, 1985) define learning styles as the learner's consistent manner of response to and use of stimuli in the learning context. Dunn (1983, in Fourqurean, Meisgeier & Swank, 1990) define learning style as the way individuals concentrate on, absorb, and retain new or difficult information or skills. Fisher and Fisher (1979, in Fourqurean *et al.*, 1990) regard learning style as a pervasive quality of behaviour which persists regardless of a change in context.

Included in the definition of learning style by different theorists are concepts such as process and/or structure, emotional and sociological needs, perceptual processes (see Ginter, Brown, Scalise & Ripley, 1989), and/or thought processes (see Dunn *et al.*, 1981 for an overview of the different models of learning style theories).

Other learning style theorists see metacognitive activity and specifically the metacognitive activity involved in selecting the appropriate strategy for a particular context, as the most important aspect of style. Schmeck (in Dunn *et al.*, 1981; Leiden, Crosby, & Follmer, 1990; Schmeck & Meier, 1984) for example, developed a learning style scale called Elaborative Processing, according to which learning style is seen as the product of the organization of a group of information processing activities for which individuals show a preference when confronted with a learning task. The group of information processing activities range from deep and elaborative to shallow, repetitive and reitative. Taylor (1987) is of the opinion that the identification of learning styles, with the aim of devising instructional material, have not taken sufficient cognizance of process theory, especially the metacognitive processes involved in learning.

4.1.2 The Aim of this Chapter

Many learning style theories exist. In this discussion we will limit ourselves to the discussion of two theories, i.e. Kolb's Experiential Learning Theory, and Davis and Schwimmer's Relational Thinking Style Model. Kolb's theory is discussed rather extensively, because it is based on systems theory and principles and is therefore a dynamic and optimistic view of learning. Davis and Schwimmer's theory is process-oriented and the theory is important because of the specification of cognitive processes involved in learning.

The aim of this discussion is to look at the effect of learning styles on the effectiveness of learning behaviour in different contexts, including educational and organizational contexts.

When considering the theories presented in this chapter, it is important to keep in mind that learning styles are complex. Even though the descriptions offered by the various theorists are done by offering typologies, which may lead us to consider learning styles in simple terms, it should be remembered that this is only descriptions of general patterns which can combine in unique ways to form an individual's learning style and in this way subtypes may be formed. Therefore, although most learning style theories are described as if pure types are represented, this in practice is not true.

Furthermore, situational variables play an important role in the determination of learning style. Therefore, the same individual can display two different types of learning styles in two different situations, also displaying the complexity of learning styles. Learning styles should therefore be thought of as situation-specific.

4.2 KOLB'S EXPERIENTIAL LEARNING THEORY

Kolb (see Kolb, 1984) attempted to create a learning theory which is holistic, in the sense that it offers an integrative perspective combining behavioural, cognitive, and perceptual aspects of learning with experience. Therefore, his experiential learning theory is not an alternative to behavioural and cognitive theories of learning, but rather an integrative view. As the name implies, the experiential theory emphasizes the role of experience in the learning process, with a special emphasis on immediate concrete experience as a focal point of learning. This differentiates the theory from other learning theories.

Kolb's theory had its origins in the work of Dewey, Lewin and Piaget. According to the Lewinian model learning is seen as a four-stage cycle, which includes concrete experience, observations and reflections, formation of abstract concepts and generalizations, and testing implications of concepts in new situations. Dewey's model of the learning process, very similar to that of Lewin, emphasizes the developmental nature of learning, which is also implicit in Lewin's theory (for a complete discussion of these theories, see Kolb, 1984).

According to Piaget (Kolb,1984) the key to learning is the mutual interaction of the processes of *accommodation* and *assimilation*. Accommodation refers to concepts or schemas an individual has because of experience and assimilation to the incorporation of new events and experiences into existing concepts and schemas. Therefore, learning is the result of a balanced tension between the two processes. Imitation, or the modelling of the self to the environment, occurs when accommodation processes are dominant; when assimilation processes are dominant, the result is "play" or the predomination of one's concepts and images while environmental realities are ignored. Cognitive growth, or functioning in an abstract and reflective mode (versus concrete and active), is dependent on the continual interplay between assimilation and accommodation.

Learning, in transactional terms, is therefore seen as *"... the process whereby knowledge is created through the transformation of experience"* (Kolb, 1984, p. 38), while learning style is viewed as the result of hereditary influences, past experience and the current environment.

Analysis of this definition brings several points to the fore. Learning is process-oriented (called the process of adaptation) and is not concerned with outcomes or content. Learning is also seen as a continuous life-long process based on experience. Learning involves a holistic process of adaptation to the environment, which Kolb compared to the Jungian theory of psychological types (see Chapter 5), in the sense that his theory is an attempt to describe how individuals relate to the world, including thinking, feeling, perceiving and behaving, in an integrated manner. Learning is transactional, since it involves transactions between the learner and his environment. This implies a fluid, interpenetrating relationship between objective conditions and subjective experience, so that in being related, both are essentially changed. There is reciprocal determination between learner and the learning environment and negotiation (exchange of perceptions and reactions) between members in the environment in an attempt by each to influence and/or control events and to satisfy personal needs, implying that learning is active and self-directed.

From the definition it can be seen that Kolb (1984) views knowledge as a transformation process or as a process of knowledge being created, and not as an independent entity to be acquired or transmitted. Knowledge, as learning, is also viewed as the result of transactions, in this case transactions between objective or social knowledge and subjective or personal knowledge. Furthermore, learning transforms experience in both its objective and subjective forms.

From the above it is clear that Kolb's theory incorporates the systemic view of the world by being holistic, viewing learning as transactional, reciprocally determined and as an active and self-directed process, which makes the theory dynamic.

4.2.1 Kolb's Learning Styles

According to Kolb (1984) experience can be grasped through one of two processes, namely ***apprehension*** and ***comprehension***. The process of apprehension refers to instantaneous knowledge or things which are simply there, without a need for rational enquiry or analytical confirmation. For example, apprehension includes all the sensations an individual experiences in a particular situation, such as the sounds, sights, physical sensations, etc. The process of comprehension is used to introduce order into the apprehended sensations so that these experiences can be communicated to others. Comprehension is thus the process of creating a conscious model of what occurred in a particular situation. Apprehension and comprehension form the ***prehension dimension***. Two processes for the transformation of experience is again postulated, namely ***intention*** and ***extension***. Intention refers to intellectual operations which are internalized actions, while extension refers to behavioural actions which transform objects or states. These processes form the ***transformation dimension***. Kolb equates the transformation dimension to Jung's concept of introversion and extraversion (see chapter 5). In the use of intention the essential factors are ideas viewed from a personal conception, while in extension the essential factors are objects viewed from an objective stance. To further elucidate the meaning and dynamics of the transformation dimension, Kolb refers to the work of Kagan (Kagan & Kogan, 1970) on reflection/impulsivity. According to Kolb (1984) Kagan's view of this dimension as the degree to which a subject reflects on the validity of a solution hypothesis is comparable to the European view of introversion, in that it emphasizes the positive aspects of introversion. Individuals with an extensional transformation orientation are thus seen as primarily concerned with maximizing success and therefore, give minimal attention to failure or error. Individuals with an intentional transformation orientation are primarily concerned with the avoidance of failure and error and are willing to sacrifice opportunities for successful performance in order to avoid failure and error.

These four processes combine to yield four different types of knowledge and form the basis of higher levels of knowing, namely divergent knowledge (apprehension and intention), assimilative knowledge (comprehension and intention), convergent knowledge (comprehension and extension) and accommodative knowledge (apprehension and extension). The combination of the preferred processes for grasping and transforming experience results in four modes of representing the learning process, namely concrete experience (apprehension), abstract conceptualization (comprehension), reflective observation (intention), and active experimentation (extension).

The process of learning requires a resolution of conflicts between these dialectically opposed modes of adaptation to the world, there being four modes of experiential learning postulated which are responsible for creating knowledge, skills or attitudes, by resolving conflict among them. The four modes, or abilities, needed by learners to be effective, are:.(1) ***concrete experience*** abilities (CE) or the involving of the self to the full, without bias in new experiences, (2) ***reflective observation*** abilities (RO) or reflection on and observation of experiences from a variety of perspectives (3) ***abstract conceptualization*** abilities (AC) or the creation of logically sound theories, and (4) ***active experimentation*** abilities (AE) or the use of such theories for decision-making and problem-solving. None of these modes are better than any of the others, but rather, depending on situational variables, it may be better to use one mode than the other.

These four orientations combine to form four learning styles, namely convergence, divergence, assimilation, and accommodation. In Table 4.1 a short description of each orientation is offered from which it can be seen how the prehension dimension and transformation dimension each form polar opposites in the modes of experiential learning.

The Four Learning Styles

Each learning style represents the combination of one mode of grasping experience and one mode of transforming that experience. As such, each style has its own unique weak and strong points. Together these styles form a learning style cycle (Marshall & Merritt, 1986). A graphic representation of this cycle can be seen in Figure 4.1. Each learning style represents certain adaptive competencies or higher-level learning heuristics facilitating the development of specific skills required for effective performance on different tasks (Kolb, 1984).

FIGURE 4.1 : LEARNING STYLE CYCLE

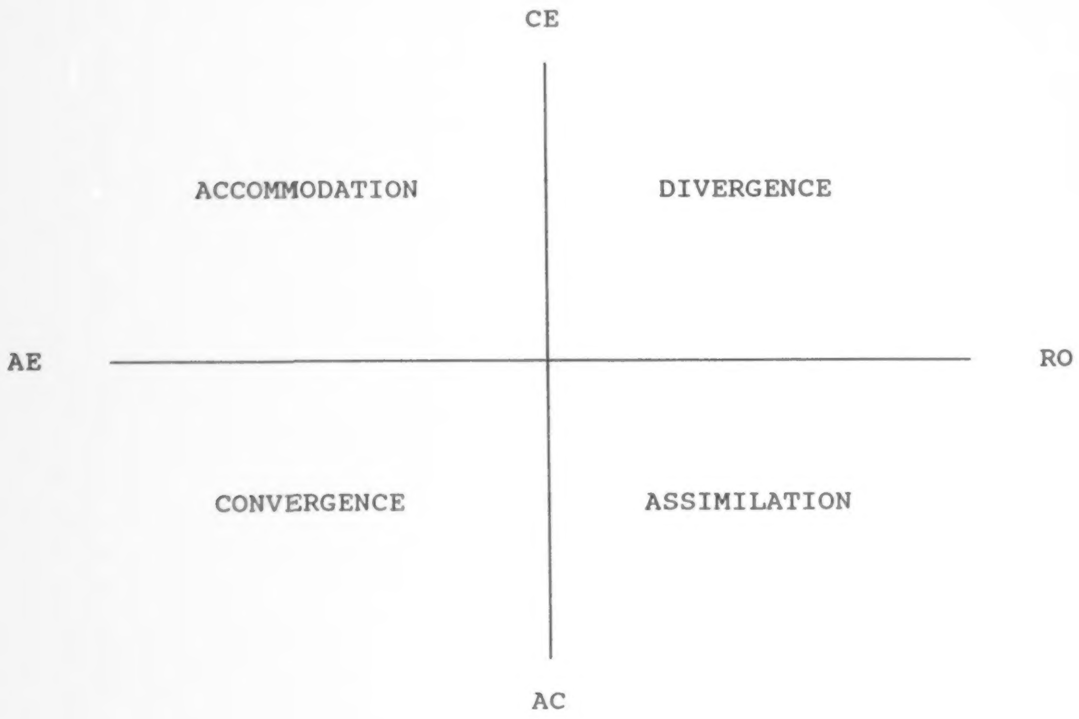


TABLE 4.1 : FOUR MODES OF EXPERIENTIAL LEARNING.

PREHENSION DIMENSION		TRANSFORMATION DIMENSION	
CE	AC	RO	AE
Focus on involvement in experiences and dealing with immediate human situations in a personal way;	Focus on using logic, ideas and concepts;	Focus on understanding meaning of ideas and situations by careful observation and impartial description;	Focus on active influence of people and changing situations;
Feeling rather than thinking orientation*;	Thinking rather than feeling orientation;	Emphasis on understanding rather than practical application;	Emphasis on practical application rather than reflective understanding;
Concerned with uniqueness and complexity of present reality as opposed to theories and generalizations;	Concerned with building general theories rather than intuitive understanding;	Concerned with what is true rather than what will work;	Pragmatic concern with what works rather than absolute truth;
Intuitive, "artistic" approach rather than systematic, scientific approach to problems;	Scientific approach rather than artistic to problems;	Emphasis on reflection rather than action; rely on own thoughts and feelings to form opinions;	Emphasis on doing rather than observing;
Good at relating to others; Good intuitive decision makers - function well in unstructured situations;	Good at systematic planning, manipulation of abstract symbols and quantitative analysis.	Good at looking at things from different perspectives and appreciate different points of view;	Good at getting things done; willing to take risks to achieve objectives;
Open-minded approach to life.	Value precision, rigor and discipline of analyzing ideas, and aesthetic quality of a neat conceptual system.	Value patience, impartiality, and considered, thoughtful judgement.	Value having an influence on the environment and like to see results.

* See Chapter 5 for an explanation of the Jungian concepts thinking and feeling.

- In the *convergent learning style* mode the individual combines abstract conceptualization and active experimentation to grasp and transform experience. The strengths of this style lie in problem solving, especially evaluation of solution consequences and solution selection, decision making and the practical application of ideas. These individuals have well developed decision skills - they do well in creating new ways of thinking and doing, experimenting with new ideas, choosing the best solution to a problem, setting goals and making decisions. These individuals perform the best in situations requiring a single solution to a problem, such as conventional intelligence tests, as was found by Kolb (1976, in Kolb, 1984) and Torrealba (1972, in Kolb, 1984). The organization of knowledge is such that it can be focused on specific problems through hypothetical-deductive reasoning. It has been demonstrated that these individuals are controlled in their expression of emotion and prefer dealing with technical tasks and problems rather than social and interpersonal issues (Hudson, 1966, in Kolb, 1984).

- In the *divergent learning style* the emphasis is on concrete experience and reflective observation. Individuals with a preference for this style have good imaginative ability and have an awareness of meaning and values. Their valuing skills are highly developed - they are very sensitive to people's feelings and values, listen with an open mind, are good at gathering information and imagining implications of ambiguous situations. Divergers are good at identifying a multitude of possible problems and opportunities. Concrete situations are viewed from many perspectives and many relationships are organized into a meaningful whole. The emphasis is on adaptation by observation rather than action. These individuals perform well in situations that call for generation of alternative ideas and implications, such as "brainstorming". These individuals are interested in people and tend to be imaginative and feeling-oriented.

- The dominant learning abilities used in *assimilation* are abstract conceptualization and reflective observation. Individuals with a preference for this style do well with inductive reasoning tasks and are good at creating theoretical models; they also excel in assimilating disparate observations into an integrated explanation (Grochow, 1973, in Kolb, 1984). These individuals have well developed thinking competencies - that is, they are good at organizing information, building conceptual models, testing theories and ideas, designing experiments and analyzing quantitative data. They are less concerned with people than ideas and abstract concepts and focus on the logical soundness and precision of the theory rather than the practical value thereof.

- The dominant learning abilities used in ***accommodation*** are concrete experience and active experimentation. Individuals with a preference for this style do well in initiating problem finding, executing solutions to problems, in carrying plans and tasks through and getting involved in new experiences. These individuals seek new opportunities, are prepared to take risks, are action-oriented, have well developed acting skills, are ready to commit themselves to objectives, seek and exploit opportunities, can influence and lead others, can become personally involved and are good at dealing with people. They fare especially well in situations where one must adapt oneself to changing immediate circumstances. In situations where the theory or plans do not fit the facts, those with an accommodative style will most likely discard the plan or theory. They tend to solve problems in an intuitive trial-and-error manner (Grochow, 1973, in Kolb, 1984), and rely heavily on other people for information rather than on their own analytic ability (Stabell, 1973, in Kolb, 1984). They are at ease with people but are sometimes viewed by others as impatient and pushy (see Kolb, 1984; Kolb, Rubin, & McIntyre, 1979).

Kolb (1984) also mentions that two other styles are sometimes, if rarely, found, called the "mixed types". It has been found that the AC and CE and AE and RO scales are not perfectly negatively correlated and that certain individuals score the highest on the AC and CE dimension, and others the highest on the AE and RO dimension. Kolb suggests that these individuals have developed styles of dialectically opposed orientations through integrative learning experiences.

Kolb's model as a learning style cycle reflects effective information processing, depicting learning in a four-stage cycle: the individual experiences something concretely (CE), which is the basis of observation and reflection (RO); these observations are in turn assimilated into an idea/theory (AC) from which it is possible to deduce implications for action, which serve as guides in acting to create new experience (AE). Most individuals develop one of the four stages as a predominant mode in learning. However, the most effective learner would use all four (Marshall & Merritt, 1986).

From the description of the four learning styles it becomes evident that having certain skills will allow individuals to function better in certain situations than in others. As was mentioned before, each learning style represents certain adaptive competencies, facilitating the development of specific skills required for effective performance on different tasks. These adaptive competencies are defined as congruences between task demands and personal skills. Therefore, Kolb (1984, pp. 95-97) offers the following definition of learning style:

> "Learning styles are conceived not as fixed personality traits but as possibility-processing structures resulting from unique individual programming of the basic but flexible structure of human learning. These possibility-processing structures are best thought of as adaptive states or orientations that achieve stability through consistent patterns of transaction with the world ..."

It is possible for individuals to develop more than one learning style, called integrative development, producing higher-order functioning, with the implication being that the individual will have a greater measure of organization and control over his or her experience. For example, the resolution of the dialectic between extension and intention can be achieved either through the combination of assimilation and convergence, resulting in an increase in the symbolic integrative complexity or through the combination of accommodation and divergence resulting in an increase in affective integrative complexity. The resolution of the dialectic between comprehension and apprehension can be achieved either through the combination of convergence and accommodation resulting in an increase in behavioural integrative complexity or through the combination of divergence and assimilation resulting in an increase in perceptual integrative complexity. Such hierarchic integration results in second-order learning feedback (Kolb, 1984).

4.2.2 The Learning Style Inventory (LSI)

The Learning Style Inventory (LSI) is a self-report instrument, measuring a person's relative emphasis of each of the four modes of the learning process.

Regarding predictive validity, Highhouse and Doverspike (1987) found that three scales of the LSI (AE, RO and CE) predicted occupational preferences in the expected directions but the AC scale did not correlate significantly with any of the scales of the Vocational Preference Inventory (VPI). It was further found that the CE scale is significantly correlated with the Artistic scale; the AE scale is significantly correlated with the Realistic, Conventional and Enterprising scales; and the RO scale is significantly negatively correlated with the Realistic, Conventional and Enterprising scales of the VPI. The AE and RO scales are also significantly correlated with the Social scale, which cannot be explained by Kolb's theory regarding the relationship of learning style to career choice.

Atkinson, Murrell and Winters (1990) also investigated the predictive validity of the LSI, using Holland's typology of six basic career personality types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. The hypothesized relationships between Holland's typology and the LSI were mostly confirmed.

As far as the stability of learning styles are concerned, Hayden and Brown (1985) demonstrated that freshmen's preferred learning modes changed over a period of three years, with a shift to Abstract Conceptualization, which is postulated to be the result of adaptation of learning style to college environment or some other developmental process. Although this motivated these researchers to question the importance of the genetic basis for learning style, it must be kept in mind that hereditary endowment is not the only variable seen as important in the formation of learning style. Kolb (1984) sees experience and situational demands as equally important. This investigation did not demonstrate what caused the shift, which may be attributed to cognitive development or environmental factors.

Since Highhouse and Doverspike (1987) found no significant correlations between the Learning Style Inventory and the GEFT (see Chapter 3) in their study regarding the validity of the LSI, they concluded that the LSI does not measure cognitive styles but rather measures preferences. It should be kept in mind, though, as was stated in Chapter 3, that the use of the GEFT as a measure of cognitive style is problematic and in this report is not acknowledged as a true measure of the cognitive style field-dependence/independence, but is rather seen as a measure of a very narrow aspect thereof.

Atkinson (1988) examined the reliability of the LSI (1985 version) and concluded from their test-retest data that revisions undertaken to strengthen the psychometric properties have not improved and may even have weakened the instrument's test-retest reliability.

Marshall and Merritt (1986) found that the LSI has two major problems: (a) use of a paired comparison, ipsative assessment approach, and (b) scale reliabilities which have been reported to fall in the .30s to .60s. They recommend for use in the assessment of learning style the Learning Style Questionnaire, developed by Marshall and Merritt, which was found to be valid and reliable and which is based on the experiential learning model.

Veres, Sims and Shake (1987) examined the LSI for internal consistency, test-retest reliability and stability of the four classifications resulting from the scores of subjects employed in industry. The results from this study were compared to the results of similar research conducted on a student sample by Sims, Veres, Watson, and Buckner (1986, in Veres *et al.*, 1987). It was found that the internal consistency of the industrial sample was comparable to that of the students. Test-retest indices and classification stability, however, remained low for the industrial sample, a failure to support the Sims *et al.* hypothesis that the learning styles of students were not fully developed and thus contributed to observed instability. The results of this preliminary study indicate that problems noted with students continue to operate in the presumably "more stable" industrial setting.

Metacognition, or the ability to understand and control thinking processes, is not directly touched upon in the use of the LSI. Training individuals to be successful learners involve certain metacognitive processes which have been identified as (1) reflection and evaluation; (2) logical organisation and presentation of thought; (3) associating, reasoning and creative use of tuition; and (4) analysis and problem-solving (Ryba & Anderson, 1987).

4.2.3 Learning Styles and Education/Training

The research findings of various studies (see Fry, 1978 in Kolb, 1984; Hayden & Brown, 1985; Kolb, 1976 in Kolb 1984) on the preferences of individuals with specific learning styles for certain learning environment factors are summarized in Table 4.2.

Kolb (1984) found that there is a relationship between educational specialization and learning styles, and concluded that one's undergraduate education is a major factor in the development of a specific learning style. It was found that undergraduate business majors tend to have accommodative learning styles while engineering students tend to be convergent learners; those students majoring in history, English, political science and psychology tend to have divergent learning styles; and those students majoring in mathematics, economics, sociology and chemistry tend to have assimilative learning styles. Students majoring in physics are very abstract thinkers falling between the convergent and assimilative quadrants. From this research, however, it is not possible to determine if learning style is responsible for choice of educational major or if educational major actually shapes the individual's learning style. Kolb concluded that the two factors most probably interact to produce a specific style.

TABLE 4.2 : LEARNING STYLES AND LEARNING ENVIRONMENTS

LEARNING MODE	HELPFUL ENVIRONMENTAL FACTORS	HINDERING ENVIRONMENTAL FACTORS
Concrete Experience	**Affectively related environmental factors:** Personalized feedback; Sharing feelings; Teachers behaving as friendly helpers; Activities oriented toward applying skills to real-life problems; Peer feedback; The need to be self-directed and autonomous;	**Symbolical and behavioural factors:** Theoretical reading; Classroom participation;
Reflective observation	**Perceptually related environmental factors:** Teachers providing expert interpretations; Teachers guiding or limiting discussions; Output judged by external criteria of field; Lecturing.	**Behavioral factors:** Task-oriented situation where info generation is focused on getting some job done; Classroom participation.
Abstract Conceptualization	**Symbolically related factors:** Case studies; Thinking alone; Theory readings.	**Affective and behavioral factors:** Group exercises and simulations; Need to be self-directed/autonomous; Personalized feedback; Teachers as models of profession; Sharing personal feelings about subject; Dealing with here-and-now info; Activities oriented toward experiencing being professional in the field.
Active Experimentation	**Behavioral oriented factors:** Small-group discussions and classroom participation; Projects; Peer feedback; Homework problems; Teacher behaving as model of profession; Own judge of work; Activities to apply skills to practical problems	**Perceptual factors:** Lectures; Teachers as taskmasters; Having their work evaluated as simply right or wrong.

It has been established that mismatches between learning styles and academic discipline demands affect students' social adaptation to universities, undermining feelings of belonging to the university community and alienating students from faculty and administration. Kolb's research (see Kolb, 1984) demonstrated that incongruence between learning style and discipline norms results in high anomie and political alienation. It was also found that students with learning styles congruent with those of departmental norms tend to be highly involved with their peers.

Hayden and Brown (1985) found that freshmen and seniors differed in their learning phases. Freshmen were heterogeneous in learning styles, whereas seniors were homogeneous and preferred "abstract conceptualization". The research of Mentkowski and Strait (1983, in Kolb, 1984) also demonstrated that while students have predominant preferences for one learning style when entering college, this changes after two years, so that they demonstrate equal preferences for the four styles, with a shift from concrete to abstract and from reflective to active. Kolb (1984, p. 206) concluded that the "environmental press of the college dedicated to experiential learning concepts can cause students to be more balanced in their learning style preferences, and when they are ready to enter their specialized professional programs, they have already experienced multiple learning modes."

The above discussion illustrates how important learning styles are in educational settings, influencing not only academic achievement but also social behaviour.

4.2.4 The Use of Learning Styles for the Design of Teaching Methods and the Matching of Teaching Styles

Kolb (1984) is of the opinion that learning environments which operate according to a learning theory dissimilar to a person's preferred style of learning is more likely to be rejected or resisted by that person. It is therefore important that teachers and students become aware of their respective learning styles, so that the student can gain insight into why the subject matter is taught as it is and what adjustments are needed to master the material. This will also help the teacher to accommodate to the variety of learning styles in the classroom. When accommodation is not possible, empathy and communication can also facilitate better understanding of instructional material.

There is also a need to individualize instruction, since most traditional classroom teaching methods are too homogeneous as learning environments. The goals of the educational program should not only be the learning of content but should also include growth and creativity objectives, since more "well-rounded" students are needed. This requires the development of the weaknesses in the students' learning styles to stimulate growth in their ability to learn from a variety of learning perspectives. Such a goal will stimulate integrative development (Kolb, 1984).

Based on the research findings regarding the effect of learning styles on achievement and fit in learning environments, Kolb (1984) concluded that the LSI is a useful framework for the design and management of learning experiences. Doyle and Rutherford (1984) however, queried the existence of a relationship between achievement and the matching of teacher and learner styles. They cited the research of Cronbach and Snow (1977) and other researchers who found few consistent results.

According to Doyle and Rutherford (1984) the important relationship or interaction that exists, is one of an interaction between academic ability and the degree of structure provided by instruction. It was found (Cronbach & Snow, 1977, in Doyle & Rutherford, 1984) that students with high abilities learn well under structured **and** unstructured conditions, while students with lower abilities perform better under structured conditions. Griggs and Dunn (1984), in their review of the literature, found that learning style preferences among gifted students include independent learning, internal control (field-independent), persistence, strong perceptual ability, nonconformance and high self-motivation. Unfortunately classrooms consist of students who are generally average and do not have the built-in strengths that gifted students utilize.

Doyle and Rutherford (1984) concluded that no single dimension of learners unambiguously dictates an instructional prescription and that no compelling evidence exists that suggests matching instruction to learning is always beneficial. They are of the opinion that most students can adapt to a variety of instructional modes, and that it is better to have uniform instructional methods in classroom situations since the teacher will choose the method he or she is most comfortable with and will therefore be a more effective instructor.

This view is in contrast with that of many other researchers. Griggs and Dunn (1984), after reviewing the relevant research, concluded that significant improvements in academic achievement, student attitudes and behaviour are affected when their learning style preferences are accommodated by the teacher.

4.2.5 Learning Style and Career Functioning and Development

The use of learning styles for facilitation of career development is another important area of concern. Most individuals find that their careers go through periods of transition which require different adaptive skills. Furthermore, we live in a rapidly changing society, demanding us to accommodate to rapid changes. An example of a career which demands dramatic changes from professionals is engineering. It typically requires a transition from practical engineering to management. Management involves different skills and competencies than engineering. Individuals pursuing a career in engineering usually show a preference for a convergent style, while management requires an accommodative style of adaptation (see Kolb, 1984). Another example is the transition involved in social work, from field work to management, which requires an increase in abstract analytic competencies.

This situation causes a problem in professional education. There has been an emphasis on specialized role requirements, without consideration of learning competencies needed for successful career transition towards management. The training of medical practitioners in South Africa fits this type of situation perfectly, with minimal attention given to the affective and human qualities needed to operate as an effective medical practitioner. This type of professional education may strengthen the rigid use of one style of adaptation, so that individuals become inflexible and intolerant toward styles that conflict with theirs, and which may inhibit their ability to adapt to changing career demands. Even though educational institutions may only emphasize certain aspects of role requirements, it is encouraging that shifts in learning styles do occur as a result of a person's current job role and professional career, the current situational or task demands and the individual's personal skills. Both Kolb (1984) and Gypen (1980, in Kolb, 1984) found that changes in learning styles were directly related to the changing demands of the current job, which most probably occurs through learning on the job.

As far as the supervision process is concerned, Ing (1990) demonstrated the importance of taking into account the preferred style of adaptation of those being supervised. It would be advantageous for any supervisor or manager to be both aware of his or her own preferred style and the preferred style of learning of those under his or her supervision. In this way it becomes possible to take advantage of the strengths of the style of the trainee and to be able to teach individuals those skills which do not come naturally to them. She suggested that supervisors should pay attention to learning styles in order to individualize the process of supervision and be

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more effective at developing trainees' skills and that they should regard the supervision process as a two-way process which is mutual and reciprocal. A variety of techniques can be employed that best match each individual's learning pattern.

4.3 DAVIS AND SCHWIMMER'S RELATIONAL THINKING STYLE MODEL

Davis and Schwimmer (1981) divided learning style into two distinct and unequal categories: (1) processing systems, which involve ways of organizing ideas, including concepts such as global/analytical constructs, field-dependent/field-independent systems, and their relational styles model, and (2) input/output factors, which are ways in which content is best delivered to and expressed by the learner, including perceptual preferences and environmental factors as the learner's preferred means of expression. The input/output factors are regarded as important insofar as learning content is concerned, but the process model is seen as more important because it determines what learners will be able to do with the content, how they will organize it, how they will relate it to previous learned content, and what kinds of new associations they will make.

Davis and Schwimmer's model of Relational Thinking includeS five general styles reflecting different processing systems, each representing ways individuals set goals and identify relationships. These are: transient, digital, multi-digital, multi-relational, and meta-relational.

Transient thinkers jump from one idea to another with virtually no focus. They have short-range, random goals, without any guiding goal. They establish relationships that are random and haphazard. Their steps are nonsequential and follow no plan or pattern. Individuals using this thinking style are easily frustrated and often disruptive, so that they need specialized structure. These individuals are often seen as problem students.

Digital thinkers operate in steps (or digits) that follow one another in a linear sequence. They prefer short-range goals with predictable outcomes set by someone else. The relationships they establish reflect simple likenesses and obvious differences and are usually representational. Directions are followed very well, order and structure are preferred and imitation is often evident. Diligence and the ability to organize in sequence and the following of step-by-step procedures are characteristic of these thinkers, who work well in traditional classroom situations since they are comfortable with a basic and structured learning environment. These individuals are seen as "good" students.

Multi-digital thinkers can relate several parallel "digits" or sequences. They can state both short- and long-range goals and change goals. These individuals can set their own goals and follow them through. Relationships reflect structured organization and the multi-digital thinker sorts, groups, and uses patterns. This learner adapts well to most situations and has a long attention span, functions well in traditional settings and is also seen as a good student.

Multi-relational thinkers usually organize the world in a highly creative, imaginative way. They have many goals, but these can change and grow. They may oppose external goals, since they prefer to set and reach goals in their own way. Relationships reflect complex organizational ability and unusual choices for options. These thinkers are not easily frustrated and may work slowly as they experiment with ideas and materials. They need options, see the whole before the parts and must provide their own structure and goals. They too are often seen as problem learners.

Meta-relational thinkers can operate in any of the other styles by will, operating as transient learners for brainstorming, digital for rote work, multi-digital for planning and organization, multi-relational when creativity is needed, intuitively recognizing the value of each way of operating.

The importance of this theory has to do with the specification of processes involved in learning, which is imperative for the development of process measures of learning styles.

4.4 SUMMARY AND CONCLUSION

Kolb's experiential learning theory is regarded as important because of the holistic nature thereof, taking into account not only the characteristics of the individual in the determination of learning style, but also situational and task demands; all these variables are seen to operate in a reciprocal fashion. Although many of the hypothesized relationships posed have not been demonstrated empirically, much has already been done to validate the theory empirically. It is the opinion of the author that the Learning Styles Inventory, despite certain shortcomings, can be used fruitfully in educational settings, not only for accommodation of teacher to student, which may in many instances not be possible, but also to facilitate understanding in both the teacher and the learner of the learning process and to facilitate the development of other styles in order to become a more integrated learner. Another advantage of the LSI for use in classroom situations, is that it is easy to administer and understand.

Learning style questionnaires can also be used effectively to match task demands and personal skills of individuals, and can be used as a basis for selection in matching individuals with appropriate jobs.

Future research should, however, be conducted into the relationship of learning preferences to the manner of performance on many tasks involving specific metacognitive processes. This will clarify the relationship of individual preferences to practical learning and problem solving activities. It has already been demonstrated that a relationship between learning style and cognitive performance, career choice and career functioning exists, as well as between learning style and social behaviour.

Another important factor in learning styles is culture, a phenomenon which has received minimal attention. In the study of learning styles, especially with respect to the South African situation, which has a variety of cultures and sub-cultures, the establishment, through research, of the relationship of culture to learning style would be an important endeavour, especially when we consider the changes which are being implemented, as well as those which will have to be implemented in the educational system on all levels.

What is needed in learning styles theorizing is that the specific metacognitive processes involved in successful learning should be identified, in order to make instruction more effective. Davis and Schwimmer (1981) have attempted to do this with their relational thinking style model. However, this attempt is regarded as only skimming the surface, since effective assessment instruments have to be developed to validate theories of this nature.

5.0 JUNG'S PERSONALITY TYPOLOGY AS AN ALTERNATIVE TO COGNITIVE STYLES THEORIZING AND MEASURES

In Chapter 3 cognitive styles were discussed and although it was demonstrated that cognitive styles are part of personality organization, the individual dimensions have generally appeared to be independent constructs relevant only to cognition. Cognitive styles are, however, not limited to specific situations with cognitive task requirements, but rather, should be conceived of as an integral part of personality organization. Individuals are continually processing information in the course of their daily activities and interactions with others, so that cognitive style is actually to a great extent a determinant of behaviour. In this chapter the personality theory of the Swiss psychologist, Carl Jung, will be discussed as an alternative to traditional cognitive style conceptualizations. This theory can also be called a theory of cognitive styles, because it is a holistic view of individual functioning. From a systems perspective personality and cognition are inextricably linked to one another and are interdependent - a feature which is characteristic of the Jungian typology. How a person thinks, perceives, selects and carries out any of the processes involved in daily living or problem solving is influenced by that person's unique personality characteristics.

This chapter is an attempt to demonstrate how cognitive styles and personality types function interdependently. As far as measurement instruments are concerned, the focus will be on cognitive styles, as well as learning styles, measured by the use of self-report instruments, specifically the Myers-Briggs Type Indicator.

5.1 THEORETICAL BASIS OF JUNG'S TYPOLOGY

The disenchantment with trait psychology and linear cause-and effect research, which have failed to take situational variables into account as an influence on personality and cognition, has led researchers to turn their attention to the study of qualitative patterns. This resulted in renewed interest in typological approaches especially that of Jung. Jung's theory of personality types satisfies many of the requirements of a systemic view of the individual and offers both a view of the nature and organization of intra-individual qualities and person-situation interactions by identifying the individual's basic attitudes and orientations towards the environment.

A short description of the Jungian typology will be presented here which is viewed as a theory of individual differences in information processing (Helson, 1982).

Jung identified and defined two basic attitudes, extraversion and introversion, four orienting functions of human adaptation or basic mental processes which are divided into two pairs, that of sensation and intuition, and thinking and feeling and which are representative of the individual's orientation to consciousness. The judgmental functions, perception and judgement, implicit in Jung's theory, were made explicit by Isabel Myers in her formulation of the Myers-Briggs Type Indicator (McCaulley, 1981).

The fundamental attitude, ***extraversion or introversion***, indicates the characteristic focus of attention. Extraversion represents an orientation to objects and objective facts with attention, energy and action flowing out to the environment, which includes other individuals and objects, as a source of factual material. Extraversion, therefore, represents an orientation towards the external world. Introversion represents a subjective orientation and the individual focuses attention on concepts and ideas rather than on objects. Energy flows from the environment to the individual and he or she focuses on the internal world as source of ideas and concepts, which represents an orientation towards the internal world. This fundamental difference represents the individual's primary direction of mental functioning. Therefore, it is incorrect to think in terms of shyness/gregariousness when considering this distinction. The characteristics associated with extraversion are sociability, outspokenness, good communication skills, interest in, awareness of and reliance on the environment for stimulation and guidance and an action-orientation. Those associated with introversion are thoughtfulness, contemplative detachment and an interest in and reliance on concepts and ideas. For a comprehensive discussion of the attitudes, see Briggs-Myers and McCaulley (1985), Carlson (1985), Jung (1971), McCaulley (1981) and Willis (1986).

Sensation and intuition are perceptive functions which are data-gathering processes and involve all perceptive activities. These functions represent two opposite ways of perceiving, indicating the type of data selected, either literal or symbolic (Helson, 1982) and were labelled irrational by Jung, since they are beyond reason and "are attuned to the flow of events and operate most broadly when not constrained by rational direction" (Briggs-Myers & McCaulley, 1985, p. 12). Sensation refers to attending to sensory realities (the observable) and, on a cognitive level, to facts and details, through the use of the five senses. Intuition is a more global, less obvious process, with the focus on insight, meanings, relationships and possibilities within data that are perceived, these being worked out beyond the reach of the conscious mind. Intuition represents perception through the unconscious. Individuals with a sensation preference typically have acute powers of observation, memory for facts and details, are realistic and derive great enjoyment from the present moment, while those who prefer using the intuitive mode are attuned to future possibilities, enjoy letting their imagination run and develop the ability to see patterns at theoretical and abstract levels. Individuals with a preference for intuition enjoy learning new skills more than using them, tend to be patient with complicated situations, reach conclusions quickly (at times without considering all the facts), and dislike taking time for precision, while those with a preference for sensation, in contrast, enjoy using acquired skills and are patient when dealing with routine, but become impatient when confronted with complicated details and dislike problems for which standard solutions do not exist (Briggs-Myers & MCCaulley, 1985; Jung, 1971; Schweiger & Jago, 1982; Willis, 1986).

Thinking and feeling are judgmental functions which are data-evaluation processes, whereby information received through either sensation or intuition are processed. These functions represent basic modes of decision making. Jung thought of these functions as rational, or directed "toward bringing life events into harmony with the laws of reason" (McCaulley, 1981, p. 299). Thinking involves a reliance on reasoning, logic and coherence in decision-making. Ideas are linked together through the use of concepts and by making logical connections. Feeling indicates a reliance on personal or social values as basis for decision-making with decisions, therefore, being more personal and subjective. Individuals with a thinking preference develop strong powers of analysis, are objective and take into account logical outcomes when weighing events or problems, have a time perspective flowing from the past through the present to the future and can be called "tough-minded sceptics". Those individuals possessing a feeling orientation are typically sensitive to value issues, have a need for affiliation, are warm and seek harmony. Their time perspective is one of preservation of past values (Helson, 1982; Briggs-Myers & McCaulley, 1985; McCaulley, 1981; Willis, 1986).

The attitudes ***perception and judgement***, implicit in Jung's theory, were explicated by Isabel Myers, and describe the style of dealing with the outside world. Human behaviour is seen as quite orderly and consistent, and the variability so often perceived is seen as the result of basic differences in the way people use perception and judgement (Myers, 1962, in McCaulley, 1981). This dimension describes identifiable attitudes and behaviours to the outside world and is also used to determine which of the two preferred functions in any individual is the dominant function. For example, although a person may prefer sensation and thinking, one of these will be the more developed function and this is dependent on the judgement/perception preference (see Briggs-Myers & McCaulley, 1985 for a comprehensive discussion of dominant and auxiliary functions). Individuals with a judging preference tend to make quick decisions, while individuals with a preference for perception have a tendency to put decisions on hold and to gather more information.

The attitudes and functions discussed above represent polar opposites, since Jung viewed them as dialectically opposed, therefore independent entities. Each individual is capable of being both introverted and extraverted, or being both sensation oriented and intuition oriented, etcetera. With growth to adulthood one of the two becomes dominant, which presumably occurs through some kind of learning process. The opposing attitudes and functions become unconscious but do not evaporate and still exert a subtle effect on the individual.

For assessment purposes, it is more advantageous to think of the attitudes and functions in terms of dimensions, since it is only rarely that an individual is found favouring one of the attitudes or functions to such an extent that the other is completely suppressed, and even when this happens, it is usually evident only on one of the four dimensions. Therefore, thinking of the attitudes and functions in terms of a continuum, with the two opposite attitudes or functions at the extreme ends of the dimensions, makes more sense.

The combination of the preferred attitudes and orienting functions produces sixteen qualitatively different personality types. The type descriptions (see Briggs-Myers & McCaulley, 1985; Jung, 1971) serve as a guide for the understanding of the types and the organization of data. Individuals should not be thought of as "pure types", since they normally display characteristics of each of the attitudes and functions, with one of each pair more strongly developed. Therefore, unique differences exist within types, since the attitudes and functions which are opposite to the preferred ones are never completely suppressed but still exist as integral factors of personality. Any preference only represents a relative predominance.

5.2 THE MYERS-BRIGGS TYPE INDICATOR (MBTI)

The Myers Briggs Type Indicator (MBTI), a forced-choice, self-report inventory, which is theoretically based rather than empirically and is an adaptation of Jungian theory, attempts to classify individuals on four dimensions, these being extraversion/introversion (E/I), sensation/intuition (S/N), thinking/feeling (T/F), and judgement/perception (J/P). Each dimension has two dichotomous preferences and combinations of the four preferences result in 16 distinctive types. This instrument is primarily concerned with variations in normal attitudes and behaviour and not with psychopathology.

Numerous studies have demonstrated the reliability and internal consistency of the MBTI (see Briggs-Myers & McCaulley, 1985; Carlyn, 1977; McCaulley, 1981; Willis, 1986), which are more than adequate for adult samples and adequate, but lower, for younger samples. Construct, content and predictive validity have also been substantiated (see Briggs-Myers & McCaulley, 1985; Carlyn, 1977; Johnson & Saunders, 1990; McCaulley, 1981; Sipps & Alexander, 1987; Sipps & DiCaudo, 1988; Willis, 1986). McCrae and Costa (1989) hypothesized the existence of five factors in normal personality. Using correlational analyses, they have demonstrated that the MBTI measures four of these five factors, these being extraversion (comparable to the E/I dimension), openness to experience (comparable to the S/N dimension, with intuitors open to experience while sensors are closed), agreeableness (comparable to the T/F dimension, with feeling types agreeable and thinking types antagonistic), and conscientiousness (comparable to the J/P dimension, with judging types high and perceiving types low in conscientiousness). Their postulated fifth factor, neuroticism, is not measured by the MBTI.

McCrae and Costa (1989) launched severe criticisms against the Jungian theory and the MBTI. According to them the theory is concerned with the unconscious life of the individual, and therefore it is difficult to formulate it into an inventory, since individuals cannot reveal their subjective, unconscious life. They also criticized the descriptions of attitudes and functions outlined by Jung, since these sometimes seem to overlap. Also, the descriptions of the attitudes and functions include certain objectively observable characteristics which often do not empirically covary. For example, the description of extraversion includes the traits open, sociable and/or friendly and approachable, morally conventional and tough-minded. However, research have failed to demonstrate that these attributes cohere in a single factor. As far as the MBTI is concerned, criticism is launched against the mutually exclusiveness of attitudes and functions, with the cutting point between these seen as a true zero point rather than an arbitrary cutting point. The correspondence between Jungian descriptions and MBTI descriptions is also regarded as suspect, since, for example Jung's description of extraverts includes tough-mindedness, while the MBTI uses this term to describe the thinking function. This is taken as evidence that the Jungian concepts underlying the MBTI have been distorted. These objections to the use of the MBTI are, however, not completely warranted, since the reliability and validity of the theory were not empirically proven by Jung, but were undertaken by Myers in her development of the MBTI, with the result that the type descriptions offered in the MBTI manual have been based on research findings.

5.2.1 Empirical Validation of the Four MBTI Dimensions

The validity and internal consistency of the E/I, S/N, T/F and J/P dimensions have been demonstrated by numerous studies (see Briggs-Myers & McCaulley, 1985; Carlyn, 1977; Carlson, 1985; Carskadon & Knudson, 1978; Dachowski, 1987; Morris, 1979; Sipps & Alexander, 1987; Sipps & DiCaudo, 1988; Stricker & Ross, 1964; Tzeng, Ware & Chen, 1989).

It has been found that the E/I dimension correlates significantly with the Eysenck Personality Questionnaire extraversion scales (Morris, 1979; Sipps & Alexander, 1987) and McCrae and Costa's Extraversion factor (Dachowski, 1987; McCrae and Costa, 1989). Research indicated that extraverted types like action and getting involved in novel situations. On various tests their scores indicated that they tend to be talkative, gregarious and impulsive, and have underlying needs for dominance, exhibition and affiliation. They are more competitive and active than introverts. In contrast, introverts have been found to be more independent, solitary and self-sufficient (Carlyn, 1977).

McCrae and Costa (1989) found that the S/N index correlates highly with their Openness to Experience factor, and also with the 16PF Intelligence, Tender-Mindedness, Imaginativeness, and Radicalism scales, which are known to form an openness factor. They also found a positive correlation between the T/F dimension and needs for Affiliation, Blame-avoidance, Nurturance, and Succorance on Stein's Self-Description Questionnaire, and a negative correlation with needs for Aggression, Counteraction, and Dominance. According to these researchers, these correlations could not be predicted from Jung's definitions of thinking and feeling, but are easily understood within their broader construct of the Agreeableness factor. They viewed the T/F index as a cognitive style associated with Agreeableness (soft-hearted and trustworthy versus ruthless, suspicious and uncooperative) while the Stein scales represent interpersonal aspects of the same broad domain.

Stricker and Ross (1964) found a positive correlation between the J/P scale and the California Personality Inventory's Flexibility scale and a negative correlation with the Strong Vocational Interest Blank business detail scales. This can be taken as a confirmation of the perceiving type's openness to the environment and the judging type's preference for having things planned, organized and settled.

Perception is positively correlated with impulsiveness (see Briggs-Myers & McCaulley, 1985; Sipps & Alexander, 1987; Sipps & DiCaudo, 1988; Stricker & Ross, 1964). It is recommended that the J/P dimension's relationship to impulsivity be further investigated, even though the definition of the perception construct does not indicate impulsivity, but rather includes the processes of becoming aware (in contrast to judgement which includes the processes of coming to conclusions about what has been perceived) which is not the same as impulsivity. Sipps and DiCaudo (1988) concluded from their study that perception is related to acting on hunches and impulsivity, in that these individuals make snap decisions, seek situations offering sensation, and give up on tasks in the face of obstacles. However, these characteristics do not correspond to the description of this construct.

The problem Stricker and Ross (1964) posed, supported by McCrae and Costa (1989), is that, apart from the fact that the construct validity of the different scales have been demonstrated, alternative explanations, outside of Jungian typology for findings obtained are also possible, and these satisfactorily account for many of the properties of the scales. They viewed this as evidence that the MBTI scales, especially the E/I and J/P dimensions, are subject to influences other than the typological variables, while the other two dimensions only reflect restricted aspects of their postulated dimensions. However, Carlson and Levy (1973) do not share this opinion, and do not regard the research on which this verdict is based as construct validation of Jungian theory; they also view Stricker and Ross' verdict as premature and misleading, since their studies construed the problem of validation in strictly psychometric terms, using large samples of high school and college students. They therefore concluded that these findings "could offer little useful information about the value of Jungian typology as a framework for understanding how the individual perceives and responds to the demands and opportunities set by life situations" (Carlson & Levy, 1973, p. 562). Carlyn (1977), from her review of the literature, concludes that the individual scales of the MBTI measure important dimensions of personality and are very similar to the theorizing of Jung. Relationships with interest, value, aptitude and performance have been adequately established and she therefore recommends the use of the MBTI for a variety of purposes.

Another criticism launched against the MBTI is the dichotomous measurement approach which is seen to be limiting. Cowan (1989), for instance, proposed that each of the Jungian functions be measured separately rather than be dichotomized. He has modified the MBTI questionnaire (Form F) and from the research concluded that it is more informative to measure function strengths than function types. He found weak correlations between sensation and intuition, which suggests that some people may be strong or weak on both of these functions. The statistical independence of the functions have been affirmed in this study. However, there have also been strong criticism against this type of approach (see O'Roark, 1990) with accusations of the modified version of the MBTI being theoretically unsound.

5.2.2 Variable Interactions

The bulk of research has investigated the validity of the four dimensions separately. The effects of each of the preferences have been established. However, what is needed is an investigation into variable interactions, although it should not be expected that the four variables will always combine interactively to predict external criteria (Hicks, 1984). The MBTI predicts both single variable and interactive relationships against external criteria.

Stricker and Ross's research studies (1963, in Carlyn, 1977), as well as those of Johnson and Saunders (1990), Sipps and DiCaudo (1988), and Tzeng *et al.* (1989) revealed a significant correlation between the S/N and J/P categories, with sensors more likely to be judging types and intuitors more likely to be perceptive types.

McCrae and Costa's (1989) research did not support the MBTI as measuring truly dichotomous preferences or qualitatively distinct types, but found that four relatively independent dimensions are measured. This led them to conclude that either Jung's theory is incorrect or that the MBTI did not adequately operationalize the theory.

Certain researchers regard the independence of the dimensions as proof of the existence of the typological dimensions (see Carlyn, 1977). Others demand both the establishment of construct validity and variable interaction to establish unique type descriptions and to predict behaviour (see Hicks, 1984). More research is needed to clarify the effects of the combination of variables on behaviour.

Finally, it must be kept in mind that the MBTI is concerned with differences in normal behaviour and, therefore, no information can be gained about emotional problems or psychopathology. On the other hand, although it is used for the assessment of cognitive styles, it does not provide information on levels of creativity. Furthermore, no assumptions can be made, from the interpretation of an individual's test results, explaining the preference of certain attitudes or functions over others.

5.3 EVALUATION OF THE THEORY AS REPRESENTING A SYSTEMIC VIEW OF COGNITIVE STYLE

Firstly, Jung's typology needs to be evaluated as representing a theory of cognitive styles. This typology is intended to characterize, rather than categorize, the fundamental styles that individuals use to deal with their environment. This can be equated to cognitive style. The conception of cognition, defined as "the act or process of knowing", and which includes awareness and judgement (Mish, 1987 in Frisbie, 1990), makes it clear that Jung's concepts of perception and judgement fit easily into this definition. Also, the concepts sensation, intuition, thinking and feeling are reflections of cognitive processes involved in both learning and problem solving and are therefore descriptors of cognitive styles.

The use of this theory in the investigation of cognitive styles involves a focus on normal, mature and well-balanced individuals, without being value-directed. These styles represent very different ways of problem solving and information processing, each having their own unique strengths and weaknesses, without one being better than the other. The appropriateness of the styles is dependent on the situational demands of the tasks involved.

The bipolar nature of the four dimensions corresponds to the criteria set for cognitive style theorizing and measurement. However, it might be better to regard the functions and attitudes as continuous dimensions, and not as polar opposites having a true zero point, since most individuals demonstrate characteristics of all the attitudes and functions, although one of the pair is normally stronger developed than the other.

Jung (Kolb, 1984) viewed human individuality as the result of **transactions** with the environment. Innate predisposition and environmental influences, as well as the transactions involved between these two variables, contribute to the development of dominant attitudes and functions. Still, every individual has the capacity to function in the opposite modes, which are less differentiated and are unconscious. The preferred mode is simply more natural and developed for a specific individual (Carlson & Levy, 1973). The development of any one function or attitude over another is the result of the social environment which rewards certain behaviours and discourages others. Every culture and society has different needs, and in Westernized cultures, the need is for the development of specialized skills; every individual in that culture or society, however, also has his or her own need for fulfilment and this means that the culture's needs and individual's needs may conflict. By transactions between the individual and the culture or society the one is shaped by the other. The individual typically develops a preference for one attitude over the other, which is the combined result of innate determinants and a need to adapt and compete in the environment (Carlson & Levy, 1973; Helson, 1982; Kolb, 1984). The ideal is that the individual will also develop his non-dominant functions and attitudes, integrating those with the dominant ones into a holistic, adaptive process (Kolb, 1984).

Kolb (1984) views Jung's framework, which describes differences in the adaptive processes of individuals, as holistic, since he not only identified basic attitudes but also described four basic functions of human adaptation involved in ways which individuals deal with the external world and approach problems, whether the situation is personal or requires distinct cognitive operations such as in a learning situation. Furthermore, this mode of enquiry which only focuses on objectively perceivable events denies the existence of internal subjective experience as real, which is a one-sided view. Jung saw the internal world of the individual as equally important to the objective external reality (Jung, 1971). Personality development is not regarded solely as the result of external events acting upon the individual. Also, personal inner reality and experience are not merely reflections of these external events, but rather the result of the interaction of the individual's internal experiences and environmental influences upon him. Such a view represents a holistic view of personality development and functioning.

Since development continues right through the life cycle, Jung's type concept is dynamic rather than static, in contrast with the trait concept, in which traits are seen as stable features. Therefore, this theory represents a dynamic interactive model of personality. This is validated by Bruhn, Floyd and Bunce (1978), who found that life events influence personality types. For example, nurse practitioners became more introverted and more perceptive after one year in training than before the programme started.

The systems approach to the understanding of organisms is process-oriented, and so is the Jungian theory. This approach is very different from a mechanistic approach, which focuses on structure. According to the Jungian view, growth and change are necessary and desirable and continue throughout the individual's life so that preferences for certain attitudes and functions may change with development. Type theories often have a static orientation to type descriptions, which lead us to have a fatalistic view of the individual. This problem is not encountered in the Jungian typology, because although each individual favours one style, it is still possible to adopt and develop other styles. It is even possible to develop and use all the styles and, depending on circumstances, to use the attitude or function which is most appropriate in that situation. Such development represents holistic personality development (Frisbie, 1990). According to Dunn *et al.* (1981) the most important style may be the metacognitive style that calls upon other styles when necessary.

5.4 TYPE, COGNITIVE STYLE, AND PROBLEM SOLVING

The development of certain preferences influences the way individuals solve problems, learn, make decisions and generally process information. In this section the relationship of the dimensions to the different aspects of information processing are discussed.

Extraversion/introversion. Heppner and Krauskopf (1987) postulated that both introverts and extraverts may experience certain problems when faced with problems. The introvert, for example, finds it difficult to detect problems in the environment, because of his orientation towards the internal world. A strongly introverted individual may therefore experience difficulty in detecting interpersonal problems which may be very obvious to an extraverted individual. On the other hand, the extravert may have difficulty to properly encode interpersonal problems. The strong extravert may experience a lot of difficulty integrating discrepant information from different individuals. Therefore, these researchers advise that introverts may need help in scanning the environment, while extraverts may need help scanning out the environment once a problem has occurred. Thus, in problem solving both the introvert and the extravert may experience problems with encoding, the former because of inadequate gathering of information, and the latter because of inadequate evaluation of information. These hypotheses still need to be empirically validated.

As far as learning environments are concerned, McCaulley and Natter (1974, in Carlyn, 1977) found that extraverts prefer working on group projects, making reports to the class, and engaging in team competitions, while introverts prefer working on their own.

Sensation/intuition. According to Hicks (1984) the S/N scale has been shown to behave the most like a cognitive style measure. Individuals who are sensors have good observational powers, focus on facts and concrete data and tend to select literal information when data-gathering, with attention sharply focused and the emphasis on practical goal achievement. Intuitors tend to select symbolic information in data-gathering and focus on the possibilities, implications and complexities rather than the facts. Therefore, it can be postulated that sensors would be competent as far as the stage in problem solving involving the gathering of information (encoding) is concerned. Intuitors, on the other hand, may neglect gathering all the facts before considering the possibilities for problem solution. They are competent when developing plans and see many possibilities, but their decisions may be based on possibilities rather than facts which may present problems in problem solving. On the other hand, sensors may settle for a solution, based on the facts, without considering other possibilities.

McCaulley and Natter (1974, in Carlyn 1977) found that having a preference for sensation indicates an interest in material that is solid and real, and that these individuals like order and working towards well-defined goals. In contrast, it has been found that intuitors have a preference for using their minds and have considerable tolerance for complexity, also preferring open-ended instructions, allowing them to use their own initiative, rather than working according to a well set-out structure. It has also been demonstrated that sensors prefer to perceive the world strictly through their five senses, preferring to work with objective, tangible, readily available data, while intuitors prefer to perceive the world more indirectly. Intuitors make greater use of the unconscious, place an emphasis on ideas and possibilities in their perceptions, do not stick with the concrete and show an interest in abstract ideas rather than tangible things (Carlyn, 1977; Carskadon & Knudson, 1978). Carskadon and Knudson (1978) using O.J. Harvey's This I Believe Test for conceptual systems which is based on a dimension of concrete-abstract, found that sensors were more likely to be found among individuals in the lower conceptual systems, that is those open to agreement with generalized external standards but closed to violations of these, while intuitors were more likely to be found among individuals in the higher conceptual systems (being more abstract reasoners and being more open to the expression of autonomy and multiple alternatives). Ross (1966, in Carlyn, 1977) also found that while change threatens sensors, intuitors have a positive attitude towards it. These findings are interpreted as supporting the theory that intuitive types would rather consider the possibilities of a situation than practical facts.

Intuitors have a major advantage over sensors in science achievement and other intellectual variables (see Reynolds & Hope, 1970). They do exceptionally well in tests measuring reading ability, concept mastery, arithmetic reasoning, and general knowledge (McCaulley & Natter, 1974 in Carlyn, 1977; Stricker & Ross, 1964). Ross (1966, in Carlyn, 1977) found that sensors place a high value on authority and work, and are rated as cooperative, pragmatic and willing to take direction. They are attracted to practical occupations. Intuitors prefer professions allowing autonomy, and are rated as imaginative by their superiors.

Thinking/feeling. Although thinking types may be very good at organizing facts or concepts, analyzing problems logically and weighing all the consequences of possible solutions to problems with an emphasis on truth, they may tend to ignore and eliminate human values and emotional issues when making decisions. Feeling types, on the other hand, care much about human values and human relationships, but they may ignore the logical consequences of their decisions.

While individuals with a preference for thinking tend to be objective, analytical and logical in making decisions, feeling types are more interested in human values and interpersonal relationships. This relationship was confirmed by McCaulley and Natter (1974, in Carlyn, 1977). These researchers, using the Edwards Personal Preference schedule (EPPS) scores, found that thinkers have strong needs for order, autonomy, dominance, achievement and endurance, while feeling types have strong needs for nurturance and affiliation. Kerin and Slocum's (1981) research demonstrated that thinking types use more objective data in making decisions in a problem solving task, while feeling types prefer more subjective data, although there was no difference in judging subjective data by thinking or feeling types. Thinking types require more quantitative data than feeling types in their decision-making. Thinkers tend to rely on logical structures to clarify the particular situation. They objectively organize and weigh facts, and in the unstructured problem situation used in this study, chose data highly congruent with their personality as measured by the MBTI. Kerin and Slocum (1981) controlled for the influence of the S/N dimension by using only subjects who were identified as having an intuition preference.

As far as learning is concerned, thinkers report that they prefer and learn best from the lecture approach, while feeling types prefer group projects, learning more in a harmonious setting (McCaulley & Natter, 1974, in Carlyn, 1977). Thinking types score high on the theoretical scale of the Allport-Vernon-Lindzey Study of Values (AVL), while feeling types score high on the social and religious scales of the AVL (Saunders, 1960

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in Carlyn, 1977). Thinkers are attracted to vocations requiring logical thinking, such as scientific, technical and business professions and feeling types are attracted to the helping professions (Stricker & Ross, 1962 in Carlyn, 1977). Carlson (1985) investigated the relationship between the T/F index and conflict handling. The dimensions measured included competing, collaborating, compromising, avoiding and accommodating. It was established that individuals with a preference for feeling were generally more accommodating in conflict situations.

Judgement/perception. Ross (1966, in Carlyn, 1977) found that judging types are responsible, industrious, and steady workers, who tend to display better study habits than perceptive types. This is due to their positive attitude toward work. In support of this finding, high school judging types report that they usually follow a study schedule, allocate time to certain tasks each day and are usually on time in completing assignments (McCaulley & Natter, 1974, in Carlyn, 1977). Ross further found that perceptive types are spontaneous, flexible, and open-minded, usually score high on measures of impulsiveness and express a strong need for autonomy. Judging types appear to have a strong need for order and prefer to have things decided and settled.

Judging types generally get higher grades than perceptive types and tend to be "overachievers". On tests of abstract reasoning ability and scholastic aptitude, perceptive types generally do better than judging types although they tend to get lower grades in school, making them underachievers, which might be due to tendencies to procrastinate, to be less serious about work and to be less competitive than judging types (Briggs-Myers & McCaulley, 1985).

Regarding the work environment, research indicates that judging types have a remarkable capacity for endurance and would be more likely to stick to a job than change jobs, while those individuals preferring perception enjoy changes (Laney, 1949, in Carlyn, 1977). Judging types are generally attracted to vocations requiring administrative skills, particularly business-oriented professions, in contrast to perceptive types who have a high tolerance for complexity and tend to be attracted to professions such as writing, art, music, psychology, architecture, and advertising (Stricker & Ross, 1962, in Carlyn, 1977).

5.4.1 Type Combinations

Research has indicated that interactions exist between attitudes and functions, with some combinations amplifying each other. An example is introversion and thinking, both abstracting from the object, in contrast to extraversion and feeling, both endowing the object. For example, introverts, who focus on ideas rather than objective data, use their thinking preference to develop their ideas logically, analytically and objectively. Individuals who are extraverts focus on people and objects rather than ideas, endowing them with qualities and values rather than judging them with severe logic.

It is, however, not easy to conduct research using all 16 type combinations because certain types are more generally found in populations than others. Furthermore, the need for adequate sampling would involve hundreds of subjects. Culture and social environments have an influence on type development so that some type combinations are more commonly found in certain cultures than in others. It is also important to keep in mind the dominant and auxiliary functions when considering type combination effects. A ST combination can either have sensation dominant or thinking dominant, depending on a J or P preference.

It becomes easier to study the effects of type combinations if two, or at the most three, dimensions are combined to establish variable interactions. In this section the logical type combinations for such investigations are given and research results, with respect to information processing and problem solving, discussed.

(i) IS (thoughtful realists), ES (action-oriented realists), IN (thoughtful innovators), and EN (action-oriented innovators).

Jungian theory postulates that introversion is related to an interest in concepts and ideas and that extraversion is related to an interest in things and people. However, Stricker and Ross (1964) could not establish a consistent relationship between introversion and an interest in concepts and ideas. A consistent relationship was established between an interest in social relations and extraversion, taken to be evidence of the extravert's underlying interest in things and people. Briggs-Myers & McCaulley (1985) thought that the postulated relationships would become clearer when taking into account the combined effects of the E/I and S/N dimensions. They hypothesized that IN types would have the greatest natural interest in ideas and symbols and that ES types would have the least. This hypothesis was supported by the fact that IN types earn higher grades than can be predicted from their aptitudes. This increases academic achievement differences between IN and ES types, since the latter have a higher interest in learning from real-life experiences. This finding should not be taken to mean that ES types are less intelligent, since aptitude tests do not measure practical applied intelligence as adequately as they measure intelligence as defined for academic achievement, which includes both the capacity to deal with concepts and ideas (I) and with theory and symbols (N).

Murray (1990), employing a memory-recall task, found that IN types were more prone to accept misleading information rendering them inaccurate on this task than ES types, although the former were more consistent in responses when given information after the initial presentation. These findings are attributed to the interest extraverts have in the external world, which becomes more pronounced if they are also sensors, so that they are more likely to notice details and are less likely to be misled by misleading information. Myers (1962, in Lawrence, 1984) found, as far as concept mastery is concerned, that EN types do not score perceptively above average until their N scores reach the N 36-52 range, but for IN types, each increment in intuition has a visible effect. All the students in the sample were well above average in intelligence and achievement and therefore it was concluded that introverts have a greater advantage in ideational fluency.

(ii) IT (reflective reasoners), IF (reflective harmonizers), ET (action-oriented thinkers) and EF (action-oriented cooperators).

Carlson and Levy (1973) conducted research on memory processes and type and predicted that differences in basic cognitive orientation (E/I and T/F) would be most relevant to task performance as far as short term memory is concerned. They found that IT types were more effective in remembering interiorized, neutral stimulus material, in contrast to EF types who are more effective in remembering novel, social, emotionally-toned stimulus material. They concluded that Jungian typology predicts stable individual differences in the use of basic memory processes. Carlson (1980) found that differences between IT and EF types also appear in personal memories. It was found thinking and feeling types differ in their emphasis on cognitive clarity versus vividness of feeling.

(iii) ST (practical stabilizer), NT (theoretical visionary), SF (social cooperator) and NF (idealistic catalyst).

According to Frisbie (1990) the above function combinations are the most compatible with cognitive styles. ST types are concerned with detail, are orderly, precise, logical, responsible and carefully consider rules and procedures. They are good at observing, ordering, recalling and categorizing. This type of individual is good at organizing and is concerned with doing things correctly. In the ST style the data-gathering process is focused on concrete data, with data-evaluation focused on conveying information simply and objectively. NT types are speculative, emphasize understanding, prefer theories above facts, are good synthesizers and interpreters, and their ideas are presented logically. They are good problem solvers, are task oriented, value competency and have as a goal thinking things through. SF types are sympathetic and friendly and facts oriented as far as people are concerned. They like to be helpful. NF types are insightful, ideas oriented as far as people are concerned, and good at imagining and forming hypotheses. NF types are concerned with existential issues and strive to make things aesthetically pleasing (see Briggs-Myers & McCaulley, 1985; Frisbie, 1990). The importance of all four styles are stressed by Frisbie (1990). For example, an idealistic (NF) approach is useful in generating new concepts and ideas; a theoretical (NT) approach can bring clarity and consistency to these ideas; a practical (ST) approach can bring data to support the theories and applications; and a social (SF) approach can find ways to use this information in helpful ways with people.

Using the MBTI-Expanded Analysis Report (MBTI-EAR), providing five subscale scores for each of the indices, Johnson and Saunders (1990) found that NT types are the most questioning individuals, although NFs can also be very questioning.

Davis, Grove, and Knowles (1990) identified four decision styles based on the MBTI. These are: (1) the ST style with a focus on facts and decision making by impersonal evaluations, leading to practical and matter-of-fact decisions; (2) the SF style with a focus on facts and decision making by weighing values and considering others, leading to sympathetic and friendly decisions; (3) the NF style with a focus on perceiving in a holistic (Gestalt) manner, recognition of a wide range of possible solutions, and decision making conducted by weighing values and considering others, leading to enthusiastic and insightful decisions; and (4) the NT style, with a focus on a wide range of possibilities in solutions, while decision making is based on impersonal analysis, leading to decisions of theoretical or technical nature which are logical and ingenious. They tested their hypothesis by using an interactive computer-simulated business environment and measuring cost performance, and significant differences were found in cost performance among the four decision-making styles. It was found that sensors performed more efficiently than intuitors in this type of task. Although it was hypothesized that those students having a ST style would outperform the other students, and would be followed by NT, SF, and NF styles, this hypothesis was not supported. The performance order obtained was SF, ST, NF, and NT. These researchers concluded that those individuals who are sensors are better able to make appropriate decisions within a moderately well-structured decision environment but that different decision environments may yield entirely different results.

Hunt, Krzystofiak, Meindl and Yousry (1989) viewed ST individuals as analytic (concentrating on detail and breaking the problem down into parts) and NF individuals as holistic (seeing a problem as an integrated whole) in terms of perception of problems. These differences determine how individuals approach complex problems, i.e. what strategies they use and which unconscious habits they will reveal. Information-acquisition is seen as related to the S/N dimension, and information-evaluation as related to the T/F dimension, with finer distinctions leading to four styles, as postulated by Davis *et al.* (1990). Hunt *et al.* (1989), however, conceived of these two styles as pure styles, with NT and SF individuals seen as employing a mixed style. They investigated decision making style as it concerned strategic issues in a corporate environment, and found that decision-making style and decision strategy preferences are congruent, with subjects significantly expressing a preference for an advisor's decision strategy when it is congruent with his own. Although the hypothesis of congruency of cognitive style and decision strategy was confirmed, the generalizability of the conclusions may be limited because of the case used and the design of the simulated dialogue.

(iv) SJ (realistic decision-maker), NJ (visionary decision-maker), SP (adaptable realist) and NP (adaptable innovator).

Not much research thus far has been conducted using the above type combinations. As far as perception is concerned, research established that NP types, who are open to latent possibilities, are significantly more successful in interpreting emotional expressions when compared to SJ types, who emphasize concreteness and closure.

(v) SP (Dionysian Temperament), SJ (Epimethean Temperament), NT (Promethean Temperament) and NF (Apollonian Temperament).

The use of the above four style combinations or "temperaments" was recommended by Keirsey and Bates (1984). It would however, be sensible to regard these type combinations simply as theoretical postulations even though they make intuitive sense, since no research is offered by these writers to support their type descriptions according to these combinations. It is not logically sound, combining the sensation end of the S/N dimension with the judging/perceiving dimension and the intuition end of the S/N dimension with the thinking/feeling dimension.

5.4.2 The Relationship Between Type and Other Cognitive Style Measures

Research showed a relationship between thinking/feeling and field-dependence/independence, with field-dependence related to feeling and field-independence to thinking (Schmidt & McCutcheon, 1988). Since no other significant correlations were found, it was concluded that the MBTI scales and the measures selected to measure field-dependence tap independent cognitive dimensions or different aspects of field-dependence.

By controlling for sex, and using only subjects with clear preferences on the sensation/intuition and judgement/perception dimensions, Hunter and Levy (1982) investigated the relationship between individual differences in problem solving performance on Dunker's Box Problem and Witkin's Embedded Figures Test and personality type. The study of Hunter and Levy (1982) and Schmidt and McCutcheon (1988) found a definite relationship between NP and field-independence, with NP subjects significantly more field-independent than SJ subjects. They take this as confirming the hypothesis that NP types are more creative, more conceptually and perceptually flexible and less constrained by concrete aspects of perceptual stimuli. NJ types were found to be less competent in solving embedded figures problems than the NP types, but they listed more possible solution items for the Box Problem than the other types. This relationship was expected because of the NJ's tendencies to see possibilities and to be systematic, orderly and persistent.

Taking all sixteen types into account, Schmidt and McCutcheon (1988) found that the most field-independent groups were the ENTP and INFP groups, while the ESFP, ISFJ, and ESFJ groups were the least field-independent. This finding is to be expected, since the types ESFP, ISFJ and ESFJ are particularly sensitive to social cues and have highly developed interpersonal skills. These characteristics are related to field-dependence, while the ENTP and INFP descriptions of analytical thinking and well developed problem-solving capabilities fit a field-independent thinking style (Witkin & Goodenough, 1981 in Schmidt & McCutcheon, 1988). From the correlations obtained in the above studies, it can be concluded that the MBTI scales are related to field-dependence but are not identical to those measures. The above findings support the notion that different personality factors affect problem solving, but is dependent on the interaction between personality and the type of problem to be solved.

Ferguson and Fletcher (1987) investigated the relationship between cognitive complexity and psychological type, and hypothesized that the intuitive person, preferring a less obvious, more abstract process of perception would demonstrate greater cognitive complexity and greater cognitive integration since their preferences would facilitate this. They found a positive association between intuition and cognitive integration, but although there was an association between intuition and cognitive complexity, this was not statistically significant. As far as cognitive complexity is concerned, it would be interesting to investigate variable interactions.

5.5 TYPE AND LEARNING STYLE

There is a close conceptual affinity between learning style and psychological type. Jung's conception of psychological type includes the preferences various individuals have for processing information and decision-making, and as can be seen from the definitions of the functions offered in section 5.1., individual differences in the preferred modes of interacting with and receiving of and responding to information exist. Barger and Hoover (1984) are of the opinion that psychological type is descriptive of what we today call learning style and cognitive style.

As was stated in Chapter 4, Kolb viewed the Jungian concepts as corresponding to his conception of learning style. As has been explained, the attitudes introversion/extraversion are seen as related to the transformation dimension of experiential learning. Furthermore, the prehension dimension is seen as related to the sensation/intuition and thinking/feeling dimensions, with concrete experience associated with sensation and feeling, and abstract conceptualization associated with intuition and

TABLE 5.1 : THE RELATIONSHIP OF JUNGIAN TYPES TO LEARNING PREFERENCES

EXTRAVERSION	INTROVERSION
- Prefer being active in learning situations; - Prefer oral presentations of material to be learned; also like to present material orally to others; prefer and perform better in dialogue situations. - Prefer social contacts and group projects; - Like psychomotor activity.	- Are highly reflective in learning situations; - Perform better in situations which do not require much dialogue and interaction and prefer working individually; need time for internal processing; - Has a need for solitude.
SENSATION	**INTUITION**
- Has a need for order; - Prefer a step-by-step, practical approach; - Field-dependent (this is not a consistent finding - field-independent sensation types have been identified by Eggins*); - Prefer set schedules, set goals; - Prefer use of films, audiovisual aids; - Prefer tasks that call for carefulness, thoroughness, soundness of understanding; - Prefer tasks that call for observing specifics; - Prefer tasks that call for memory of facts.	- Has a need for autonomy and situations requiring imaginativeness; - Need for theoretical orientation to material; - Field-independent - Prefer to work on own initiative and like doing non-required reading, but experience problems with time-management; - Good at finding own way in new material; prefer reading and have intellectual interests (independent of intelligence); - Prefer tasks that call for quickness of insight and in seeing relationships; - Prefer tasks that call for grasping general concepts; - Preference for tasks that call for imagination.
THINKING	**FEELING**
- Prefer logical organization of material and teacher; - Prefer serious, business-like approach to material and by teacher; - Enjoy formal lectures; - Preference for study of objective material.	- Prefer non-technical subjects and approach; - Need for affiliation, nurturance and social contact in learning situation; need personal rapport with teacher; - Enjoy group projects; - Prefer learning through personal relationships.
JUDGING	**PERCEPTION**
- Need for order and formalized instruction; - Structured-motivated: Prefer structured environment for learning; are motivated, enjoy drill and recitation, teaching games and independent study; - Drive toward closure, completion.	- Need for change, working in flexible way, autonomy and to follow own impulses; - Unstructured-casual: Prefer unstructured and informal learning and problem solving; can function well in a noisy environment, and enjoy tactile learning and discovery tasks; - Good at managing emerging problems.

* see section 5.5.1 (Eggins, 1979 in Briggs-Myers & McCaulley, 1985).

thinking. The research of Taylor (1973) and Wynne (1975) partly supported this relationship, although the findings were not consistent for all groups (see Kolb, 1984).

Margerison and Lewis's (1979, in Kolb, 1984) research demonstrated that sensation, as dominant function, is related to an accommodative learning style, while intuition, as dominant function, is related to an assimilative learning style. Individuals having feeling as dominant function are divergent learners while being thinking dominant indicate convergent learners. In self-descriptions it became evident that extraverts are active in learning situations while introverts are highly reflective (Margerison & Lewis, 1979, in Kolb, 1984). The above research findings taken as a whole, led Kolb (1984) to postulate that the personality type associated with accommodative learning tends to be extraverted sensation. Introverted feeling is seen as related to the divergent learning style, introverted intuition to the assimilative learning style, and extraverted thinking to the convergent learning style.

A summary of the major findings regarding the Jungian typology and learning preferences are provided in Table 5.1. See Carlyn (1977); Fourqurean *et al.* (1990); and Lawrence (1984) for detailed discussions of research findings.

Fourqurean *et al.* (1990) found the most important dimensions to be extraversion/introversion and judging/perception, as related to learning preferences, using both the MBTI and several learning style questionnaires in their research. From their research they identified two bipolar learning preference dimensions, namely active/reflective, being related to the extraversion/introversion dimension and structured-motivated versus unstructured-casual, being related to the judging/perception dimension (see table 5.1 for an explanation of these terms).

5.5.1 Instructional Methods

A success profile for university students at risk of dropping out has been established by Nisbett, Ruble and Schurr (1981, 1982 in Lawrence, 1984), with the high risk students being those with a perceiving preference. Students with a judging preference were less likely to drop out or fail. The success profile for high risk students included preferences for: (1) formalized, traditional classroom instruction; lectures, memorization, objective tests, concrete thinking, facts, teacher-directed time-management of assignments; (2) predictable academic routine: inflexible syllabus; (3) teacher-established, group-directed learning goals; and (4) immediate closure in decision-making: teacher should announce projects, test dates, types of tests, and reading assignments. These researchers found that high risk perceiving types need direct assistance to adjust to instruction and need continual reinforcement by the counsellor on their progress in study skills and habits.

Briggs-Myers and McCaulley (1985) report on the study by Eggins (1979) in which an aptitude x treatment x interaction study of the effects of three methods of teaching was carried out. The instruction was carried out with the use of slides and audiotape, but structured according to three different learning models of concept attainment, namely, (a) an inductive approach, which imposes very little structure on learners; (b) a didactic approach using an advanced organizer model, that helps students see links between already familiar concepts and new material and thus represents a structured model but with an advanced organizer designed to help students relate facts to concepts; and (c) a highly structured presentation using concrete examples and moving from concrete examples to more abstract concepts, based on a linear structure. The instruments used in this study were the MBTI, a reading comprehension test as a measure of crystallized intelligence, the Figures Analysis Test as measure of fluid intelligence and the GEFT as a measure of field-dependence.

The postulation that intuitive types would benefit the most from the inductive approach was confirmed. It was also postulated that sensation types would benefit most from the highly structured approach. This too was confirmed, but only for field-dependent sensation types. Those who were field-independent benefited most from the didactic approach. As far as the judging/perception dimension is concerned, students with high crystallized intelligence who were judging types benefited most from the inductive and didactic approaches, while judging types with low crystallized intelligence benefited most from the highly structured approach. The opposite was true for perceptive types: those with high crystallized intelligence benefited most from the highly structured approach, while those with low crystallized intelligence benefited most from the didactic approach. Regarding type combinations, SJ and NJ types succeeded with all three models, while the SP and NP types were significantly affected by the instructional design. NP types benefitted by the use of the inductive approach and remembered significantly less if taught by the structured approach; SP types were most successful with the structured model. The results are consistent with the theory, in that intuitive types respond well to instruction demanding the identification of relationships and possibilities, while sensing types respond well to instruction that calls for observation of details in information presented in a step-by-step fashion. The major findings of research on learning preference relationships are summarized in Table 5.2.

TABLE 5.2 : LEARNING PREFERENCE RELATIONSHIPS WITH SPECIAL REFERENCE TO SPECIFIC TYPE COMBINATIONS

IS TYPES	IN TYPES
(1) Demonstrations; (2) Laboratory work; (3) Computer assisted instruction; (4) Films, audiovisual aids; (5) Facts, facts and more facts; (6) Dislike independent study.	(1) Serious reading; (2) Tutorials; (3) Independent study; (4) Systematically organized courses.
ES TYPES	**EN TYPES**
(1) Television; (2) Reports to class on topics selected by students; (3) Scheduling time; (4) Having a schedule and sticking to it (5) Orderly work on goals set in advance.	(1) Reading; (2) Self-instruction; (3) Courses that put person on own initiative; (4) Working on group projects; (5) Meeting a lot of people; (6) Opportunities to be creative and original.
ST TYPES	**SF TYPES**
(1) Demonstrations; (2) Laboratory work; (3) Television; (4) Having a plan and sticking to it.	(1) Student-led demonstrations or presentations; (2) Instruction with personal involvement; (3) Television; (4) Films and audiovisuals; (5) Having a study schedule.
NF TYPES	**NT TYPES**
(1) Learn through personal relationships; (2) dislike impersonal, didactic instruction; (3) Highly value faculty feedback; (4) Value student enthusiasm; (5) Low-friction student-led discussions; (6) Opportunities to be creative and original.	(1) Organized teacher lectures; (2) Self-instruction; (3) Reading; (4) Systematically organized courses.
SP TYPES	**SJ TYPES**
Structured exploratory observation, hands-on.	Structured didactic, sensory rich instruction.
NP TYPES	**NJ TYPES**
Low structure, inductive instruction	Moderate to high structure, "serious" instruction.

It is important to take individual differences into account when planning problem-solving training. Problem-solving training programmes should be tailored to suit individuals' unique personality patterns, making them aware of how they differ from other individuals and showing them what constitutes the strengths and weaknesses of their particular style.

It is important to keep in mind the four-way interaction proposed by Barger and Hoover (1984), when considering the relationship between psychological type and learning style, namely the interaction among psychological type of the student, psychological type of the teacher, demands of the particular instructional alternative in use, and the logical form of the subject-matter discipline or field being studied.

Differences in psychological type or learning preferences between teachers and students can lead teachers to misunderstand learning styles of students. Teachers usually impose their learning style on the students and should one with a ST preference, for example, impose a logical, detailed approach on a student with a NF preference, who has a holistic and value-oriented learning style, this student may find it extremely difficult and confusing to comprehend the instructional material. In this way teachers can confuse their students and even have them rebel against them, which can lead to interpersonal difficulties and communication problems.

When designing instructional methods, it is important to keep in mind practical considerations. As far as learning style preferences are concerned, it is not only important to cater to the needs of specific individuals, but also to help them to function in other modes. For example, Barger and Hoover (1984) propose that thinking types should be helped to process information holistically as well as logically and to incorporate value considerations in learning and communicating, while feeling types should be assisted to incorporate logical analysis as well as values in decision making and to use logical processes in learning. Those students with a sensation preference should be assisted to become open to possibilities as well as the realities of experience and should be helped to utilize imagery and hunches in learning. Those students with an intuitive orientation should be assisted to perceive details as well as patterns, to consider present realities as well as possibilities, and to increase factual accuracy in learning.

The following suggestions are made by Briggs-Myers and McCaulley (1985) for remedial teaching programmes, all of which have been tested by them and proven to be effective: (a) Sensation types should be taught to generalize beyond immediate facts; (b) intuitive types should be taught to become more accepting of traditional instruction and testing methods; they should also be taught to pay more attention to details and not to rely solely on their understanding of general concepts; (c) sensation-perceptive types must be helped to accept practice and routine; and (d) intuitive-feeling types must be taught to redirect extreme idealism.

5.6 CROSS-CULTURAL STUDIES

It is unfortunate that the MBTI have not been validated on South African samples, even though it is widely used in industry for selection, training and career counselling purposes. Since this instrument is very promising, it is proposed that attempts be made to validate it using local samples, both black and white, since the research reported in this study pertains largely to white middle-class American samples. Levy, Murphy and Carlson (1972) cited evidence that results derived from the use of white samples cannot be generalized to black subjects, since motivational, cognitive, and affective variables appear to be patterned differently in different ethnic groups.

For example, Levy *et al.* (1972) found striking differences between American black and white samples. Of their first black male sample one-fourth was categorized as ESTJ, but only 9.3 percent of the white sample was of this type. They found a diversity of types among white students which was not parallelled by the black sample. In fact, nearly half of the black subjects were STJ types. Using a female sample, it was found that one-fourth of black women were SFJ types, but that the major types among the white female sample were NFP types. They found very few black students with intuition and perception preferences, and together with the finding that socio-economic status is related to the S/N dimension, with lower socio-economic status associated with a preference for sensation, these researchers proposed the reason being the experience of living in a "majority" dominated world. These individuals need to attend to immediate and concrete details in order to survive and to meet their achievement needs. This impose constraints upon the development of "innate" preferences for intuitive, perceptive modes of experience. Hedegard and Brown (1969, in Levy *et al.*, 1972) report that black students indicate that their parents have encouraged them to deal with the world as a set of concrete, tangible entities, in contrast to the white students who indicate that they have been encouraged to develop abstract, intellectualized ways of conceptualizing their environment.

In the South African situation we will most probably also find disparities between the preferences of white and black samples, but the explanations therefore will be quite different from the American one. We have a disadvantaged black population living in a "minority" dominated world, facing enormous social, economic and political problems.

5.7 SUMMARY AND CONCLUSION

Jung's theory demonstrates the interrelatedness of information processing, learning and personality factors. This typology represents a holistic, dynamic and process-oriented view of individual functioning and differences, with the focus on both attitudes which are involved in the focus of attentional processes and style of dealing with the external world, and functions involved in data-gathering and data-evaluation. The value of Jung's theory lies in the fact that it represents a systemic view of personality organization. Instead of concentrating exclusively on the influence of personality factors on behaviour, or the influence of situational variables on behaviour, the theory represents a transactional view, with the focus on individual as well as situational variables, together with the unique product thereof produced by transactions. Therefore, the assessment of the style of execution of cognitive tasks or learning tasks takes into account individual and situational variables.

Research has shown that Jungian theory and the MBTI can be fruitfully put to use to assess cognitive and learning styles, is valuable for use in educational and organizational settings, specifically for the development of teaching methods, to facilitate understanding in educators and insight in students regarding type differences in motivation and interest, and to help students gain control over learning. The MBTI is also useful in other areas, not covered in this report. For example, it has been demonstrated that the MBTI is an effective tool in the evaluation of management styles (see Schweiger & Jago, 1982), decision-making styles (see Kerin & Slocum, 1981), learning and teaching styles, the education and supervision process of professional workers (see Handley, 1982), conflict handling in organizations (see Kilmann & Thomas, 1975) and team building and group performance in organizations (see Bouchard, 1969). It can also be used to select teams and work groups intended to solve specific problems.

The Myers-Briggs Type Indicator is a promising instrument for the assessment of personality type, as well as cognitive styles and learning styles in both educational and organizational settings. However, the MBTI needs to be validated using South-African samples with a focus on the influence of culture and social environment on the determination of personality types and cognitive styles. Since the MBTI is a self-report instrument and therefore, does not identify those aspects of metacognition important for successful task performance, in the next chapter a model based on Jungian theory for the development of a process-oriented assessment instrument is discussed.

6.0 NEW AVENUES IN COGNITIVE STYLE ASSESSMENT

The use of conventional tests as selection devices for admission into educational programmes, in career counselling and for selection of personnel poses many problems. The major problem is the measurement of specific abilities without considering their relationship to the task requirements, whether these be the requirements set to successfully master course material or for the successful execution of job-related tasks. Predictions for success are based on intellectual abilities and the level of achievement the individual displays at the time when testing takes place. The level of achievement is taken to be at a stable and maximum point without considering the possibility of change and growth. Although other instruments such as personality questionnaires are employed in the selection and counselling process, these tests are usually based on trait theory, which does not take into account the dynamic nature of personality or the potential of individuals to grow and change. Traits are ascribed to individuals as if they are fixed personality characteristics.

Despite this shortcoming the use of conventional tests for assessment purposes is not regarded as outdated. However, developments in the information processing approach, with the concomitant shift in focus from structural considerations to process considerations, requires a shift in cognitive assessment procedures. Since the focus is on cognitive processes and metaprocesses necessary for the successful execution of tasks, measurement instruments need to be designed to assess these processes. In this report the focus has been on cognitive styles, which requires that attention be given to the metacognitive processes involved in the determination of style differences. A major shortcoming of cognitive style assessment, however, as has been demonstrated, lies in the type of instruments used for assessment, which are predominantly based on psychometric principles, without regard for individual differences in the processing of information. Furthermore, in many cases cognitive styles are defined in terms of cognitive considerations only, without the consideration of personality and other variables which also contribute to the development of styles.

In the following sections an overview of the requirements for future research, as it pertains to cognitive styles, as well as a model for the development of an instrument for the assessment of cognitive styles fulfilling the need to assess the process aspects, is offered.

6.1 RECOMMENDATIONS FOR FUTURE RESEARCH

6.1.1 Those cognitive style dimensions which are value-directed (see section 3.2) should not be thought of as styles, but rather as skills. It remains important to conduct research on dimensions such as reflection/impulsivity, flexibility/rigidity and abstract/concrete thinking, so that deficiencies in task strategies can be identified and individuals can be trained to become more successful problem solvers. The identification of strategy-related deficits is imperative for the development of the potential of individuals and should ideally be attempted at an early age, preferably in primary and secondary educational environments.

New instruments have to be designed to assess performance on these dimensions in order to overcome the methodological problems identified for those instruments currently in use.

For cognitive style remediation the use of Baron *et al.*'s (1986) normative model is recommended, especially for remediation of problems experienced with the successful execution of subject-related tasks and learning. This model can be applied to many strategy and skill deficits.

6.1.2 Theoretically, problems are not experienced with those dimensions classified as representations of "pure" cognitive styles. However, what is required is the design of process measures to assess these styles, as well as a reinterpretation of previous research based on the use of psychometric measurement instruments.

6.1.3 As far as selection for tertiary education courses is concerned, especially university courses, we find that the norms for entry into certain professions are extremely rigid, so that some individuals are automatically excluded from entering courses to be trained for these professions. This is especially true in the South African situation where many individuals have been forced to accept a second-rate education on primary and secondary school levels. It is important that, although these individuals have been given an inferior education, they be brought onto the same level of cognitive functioning than their more advantaged peers when they actually possess the same level of potential.

There are a few steps that can be taken to remedy this situation. The development of instruments to train these individuals to be effective learners and problem solvers is important, so that they will have equal opportunities to enter certain educational fields and careers. It is important that, in the development of testing, training and/or remediation material, psychologists and educators become responsive to the special needs of disadvantaged individuals. Instruments developed for the identification and remediation of skill deficits can also be employed for this purpose (see 6.1.1).

In educational settings it is important to identify learning styles in order to facilitate learning. The use of learning style questionnaires is recommended for development of potential, the enhancement of the current learning style or to learn to use a style fitting the specific situational requirements. The use of Kolb's Learning Styles Inventory can be advantageous to both educators and students, since the questionnaire is easy to administer and understand. What is needed is the validation of this questionnaire using South African samples. Cross-cultural studies must also be carried out to determine the influence of culture on learning style.

Although Kolb's instrument is an important assessment device, just as are many other learning styles questionnaires, what is lacking, since it is a self-report instrument, is an evaluation of the metacognitive processes involved in successful learning. Researchers would be well advised to concentrate on process theory in the design of new instruments and instructional material. The Relational Thinking Style model of Davis and Schwimmer (1981) can be used as a starting point in this regard. These authors have already specified many of the metacognitive processes involved in the processing of information as it relates to the learning situation. What is lacking is an instrument capable of validating the theory and assessing the specified processes as they pertain to specific learning situations. In order to teach individuals to be more successful learners it is also important to develop their thinking skills and therefore, such an instrument needs a diagnostic as well as a training element.

6.1.4 Individuals entering organizations fresh from university or other career preparation courses enter these organizations with a vast amount of knowledge specifically related to that profession. Learning, however, does not end when formal education ends but is a life-long process. The areas of team work in organizations, management skills, dealing with professionals in related fields and interpersonal skills do not receive much attention during career preparation and most individuals need further training to become successful in their careers.

Therefore, the organization becomes responsible for the development of the practical skills the individual needs to be effective in task execution and to be an asset to the organization. Other skills which are neglected in the training of professionals which indirectly influence the effectiveness of the professional in the organization, are self-development and the development of insight into the self, managing relationships with other individuals, handling social and interpersonal problems, and ethical issues involved in carrying out professional work. Training programmes are therefore becoming more and more important.

Sample and Hoffman (1986) are of the opinion that business, industrial and governmental organizations often treat their human resources more alike than differently, ignoring individual differences in work settings. These writers propose that "the recognition of a diversity of personality types in an organization and their utilization may have the potential for generating higher levels of creativity and productivity" (p. 47).

Instruments such as Kirton's Adaption-Innovation Inventory (KAI), Kolb's LSI and the Myers-Briggs Type Inventory (MBTI) have potential for use in organizational settings, especially since these instruments take into account personality differences which account for differences in task orientation and help to facilitate understanding of the functioning of the individual and colleagues. The MBTI can also be utilized in all of the following areas of the organization: communication, general management development, group dynamics, information processing, career development, leadership, managerial problem-solving styles, management and staff training and development, motivation, organization development, organizational evaluation, etc. Therefore, validation of all the abovementioned instruments, using South-African samples, as well as cross-cultural studies, are of extreme importance.

Productivity is another important factor in organizations. An individual's thinking and communication styles are very personal, and misunderstandings and conflicts can be avoided if individuals have insight into their own thinking styles and that of their co-workers. Thier (1989) suggests that individuals in an organization should learn a common problem solving language in order to keep the workforce motivated and productive. Being productive does not always mean working with people that think like you do, hence the importance of understanding, so that where people are required to work as a group, they can do it in a harmonious and productive fashion.

From this report it can be seen that two types of instruments are mainly used for the assessment of cognitive styles, those based on psychometric principles and self-report instruments. A middle ground between the two approaches is needed, i.e. an instrument which focuses on the processes and metaprocesses involved in cognitive styles. In the next section the development of such an instrument is considered.

6.2 A MODEL FOR THE DESIGN OF COGNITIVE STYLE MEASURES

The use of the Jungian typology and experimentally-based cognitive theories for the development of a cognitive style assessment instrument is recommended. The reason for this is the dynamic and holistic nature of Jung's theory which includes both personality and information processing variables. By using Jung's typology and combining it with the work done by information processing theorists and researchers it becomes possible to design a process-oriented assessment instrument with the goal to determine the typical and preferred mode of information processing, or what is called cognitive style. Such an instrument can take cognizance of the three major factors involved in the determination of cognitive style, i.e. the situational requirements of the task, the characteristics of the individual and the interaction of these two variables. Such an instrument can be useful for selection of personnel, but is intended especially as a diagnostic instrument, i.e. the identification of styles, with a training element in that individuals can be taught to use different styles to solve problems. Therefore, the instrument will satisfy the requirement of value-differentiatedness and can point to both the strengths and weaknesses of a particular cognitive style. Value-directedness will be avoided in the sense that problems will have more than one possible solution, depending on the individual's frame of reference. For example, one individual can arrive at a solution judged to be feeling-oriented because of a preference for operating in the feeling mode, while another can arrive at a different solution which is thinking-oriented because of a preference for operating in the thinking mode. The ideal would be a solution where both the feeling and thinking modes are used, as this would indicate a higher-order solution.

Since the four orienting functions explicated in Jung's theory, i.e. sensation/intuition and thinking/feeling, resemble cognitive styles the closest, the use of these two dimensions in the design of the instrument is recommended. The four attitudes, introversion/extraversion and judgement/perception, influence the manner in which individuals use the orienting functions in executing tasks. Therefore, although the S/N and T/F dimensions, which respectively represent data-gathering and data-evaluation processes, will be the major focus of attention, including the other two dimensions in the instrument is essential. However, determination of the preferred attitudes will be used primarily to identify the dominant and auxiliary functions and to determine how these influence cognitive style.

Four major styles will result from the combination of the S/N and T/F dimensions, namely ST or the practical stabilizer, NT or the theoretical visionary, SF or the social cooperator and NF or the idealistic catalyst. With the use of the E/I and J/P dimensions to determine the dominant and auxiliary functions eight sub-styles will result. This will mean that the scale to be used to determine cognitive style will not be bipolar, but multidimensional. The use of such a typology will enable the researcher to organize the data to make it more understandable. However, it is envisioned that mixed styles can also appear, especially when individuals use two opposing functions to the same extent, for example S-NT. Mixed styles can be regarded as higher-order styles, indicating that individuals have learned to use both functions to their advantage.

The proposed instrument would lend itself to be computerized after validation exercises have been carried out. This will make the administration and scoring thereof much easier and will also enable the researcher to use the same instrument or variations thereof for training purposes, i.e. problem solving and thinking skill training.

Testees will be required to execute a practical problem solving exercise directly related to the work environment which will include metacognitive processes such as data-gathering, data-evaluation, finding patterns, planning, analyzing, estimating, mapping and seeking help when required. Such exercises can either be of a general nature or be adapted to suit a specific organization's requirements. It is also possible to adapt the instrument to suit individuals operating on different levels of the organizational hierarchy. Furthermore, the exercises will also include more than just cognitive factors. Personality, social and interpersonal factors will form part of the problem space. The testee will be assigned a specific role in the scenario with the major goal to reach a viable solution.

From the above proposal it can be seen that the definition of cognitive style adopted in this report will be adhered to, i.e.: *Cognitive style, being part of personality organization, represents a characteristic mode of information processing which involves a constellation of metaprocesses. Cognitive styles, then, are stable individual preferences regarding the manner of perceptually organizing and conceptualizing the environment as well as reacting thereon or adapting thereto.* What is proposed is the design of a flexible, multi-purpose instrument to be used for selection, diagnosis, training and evaluation purposes, to fulfil a variety of organizational-related needs, such as management development and team building. However, the major focus of the instrument will be the development of the individual, specifically the development of thinking skills to enable individuals, particularly disadvantaged individuals, to leave behind the debilitating effects of unequal opportunities, inadequate and inferior education and disadvantagement brought about by social and economic factors and to fulfil their needs and the needs of the organization of which they form part. The time has arrived for researchers to apply themselves to the practical issues involved in creating equal opportunities for all South-Africans and by focusing on the imperfections inherent in current selection and training instruments and designing instruments that can overcome these, a major contribution can be made to fair labour practice.

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ISBN 0 7969 1208 4

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